THE IRON TRADE REVIEW

VOLUME XXVII. CLEVELAND, O. NOVEMBER 1, 1894. CHICAGO, ILL. NUMBER 44

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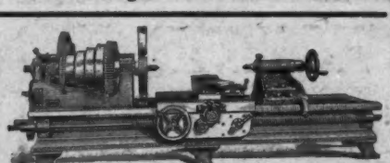

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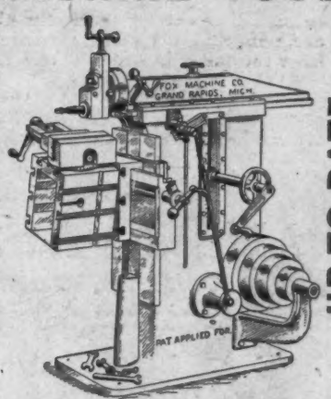

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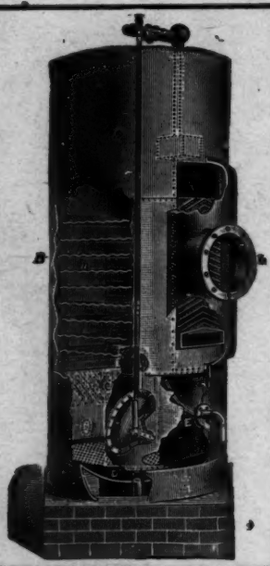

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100 Tons	30 lb.	Steel Rails and Splices.				
50 "	35 "	"	"	"	"	"
75 "	40 "	"	"	"	"	"
180 "	52 "	"	"	"	"	"
200 "	60 "	"	"	"	"	"

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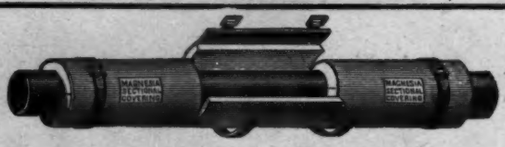

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Wallace & Bro., Baltimore, 432 E. Pratt st.
Wm. B. Morgan, Washington, Builders' Ex.
Herbert Engineering Co., New Orleans, 23 Union st.
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SHIPPER OF

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Best Grades of Coke a Specialty.

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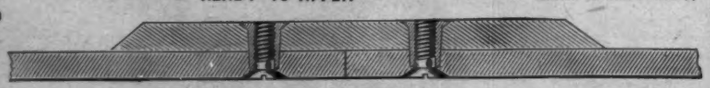
The Best Tool of its Kind in the Market



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CHEMISTS AND ENGINEERS.

THE IRON TRADE REVIEW

VOLUME XXVII. CLEVELAND, O. NOVEMBER 1, 1894. CHICAGO, ILL. NUMBER 44.

THE WEEK IN IRON CIRCLES.

GENERAL FEATURES.

The iron trade has come to a date at which calculations usually begin to be made reaching into a new year. There is much expectancy and more prophesying relative to 1895, but a practical unanimity in the opinion that if any decided change in conditions comes in the new twelve-month no signs have yet developed. In the Lake Superior ore trade another year's record is soon to be closed, with shipments likely to run closer to 7,000,000 tons than was counted on early in the season. The outlook for Bessemer ores was never more promising and for non-Bessemers demand is at the lowest point in years. Pig iron producers are finding at the end of October a less encouraging situation in some respects than at the opening of the month. The close of a year is always attended with some accumulation of iron, however, and there is no surprise at indications here and there of slightly increasing stocks, though this is less noticeable in the case of Bessemer pig. Southern furnacemen have been keeping out of the Central Western field for the most part, but a few weaker producers are responsible for cut prices in foundry and forge. Raw and finished material have so long been scraping on the bottom that it is deemed encouraging to have buyers somewhat less disposed to crowd them further. In the East a moderate buying movement resulted, in the past 10 days, from sellers conceding some of the advance on billets achieved some time ago. Alabama iron, also, sold to some extent in Philadelphia at $10 ex-ship. In the Chicago market Southern iron has fared a little better as to tonnage, but such prices were made as would get the business. The inability of the further Western railroads to borrow money for re-equipment and re-tracking is not specially encouraging to steel mills in that section who have carried long over-due hopes of a railroad revival. The belief that another week will effectually settle the question of confidence, so far as an election can do it, may be the explanation of some of the waiting in finished material lines; the fact of the falling off is more generally conceded, at all events. Western bar mill men did not get together as planned, owing to the failure to enlist important Ohio mills, and there is no outlook for a better basis for that business by such a method. Wire nail men have been working industriously on a combination, but one or two unwilling producers stand in the way. The tin plate mill deadlock is getting tiresome to some of the manufacturers and there is strong talk of a start, regardless of the scale, at two plants near Pittsburg. The much-talked-of meeting of steel rail makers has been held but there is no definite development as to the future of the agreement. Nobody wants a fight.

THE CLEVELAND OUTLOOK.

A considerable proportion of recent ore sales were made to a prominent Western steel producer; other purchases were distributed among several consuming interests. Producers of hard ore have been finding some satisfaction in the results achieved by furnacemen in mixing these ores with the fine Mesabis, and are expressing confidence that in the increasing employment of the latter, hard ores may thus get compensation for some of the neglect of the past two years. Shipments from upper lake ports are tapering off, though two or three Mesabi mines are keeping up a fair gait. One of the latter will have its hands full to get down all the ore covered by sales. Shipments from Ashland, Duluth, Two Harbors and Marquette have been heavier than were looked for, in the month just ended. When it is recalled that the total to Oct. 1 from all ports was well nigh 6,000,000 tons and that Escanaba has been more active in October than in preceding months, it is evident that the early estimate of 6,500,000 tons is now exceeded by nearly 250,000 tons. Duluth shippers have paid 90 cents for boats the past week and the Escanaba rate has been firm at 50 cents. Vessels will be tying up daily from this time out. Coal shipments, usually active at this point in the season, have been exceptionally small of late. Buyers at upper lake ports are taking special precautions against the overstocking of last year.

Pig Iron. The market for foundry iron has shown a continuing sale of small lots. Some sellers find these requisitions of foundrymen more frequent; others see no evidence that more iron is being melted. A molders' strike in a heavy machinery foundry, with prospects of a prolonged deadlock, is a local incident. Cutting is still seen on Nos. 1 and 2 foundry, though the Scotch irons of the valley are still held quite uniformly at $11 and $10 at furnace. Bessemer is quieter than for some weeks. Some iron is being piled at a few furnaces in the valleys, but there is no attempt to put it on the market. Buyers are as inactive as sellers. Meantime the market is nominally $10.25 and $10.35 valley furnaces.

Finished Material. Demand for mill products goes on at an even pace, perhaps a little more slowly the past week. Prices do not change, the mills generally having work ahead for three or four weeks, and the expectation being that after the election order books will be in better shape. Beams and channels are called for in small lots and we continue to quote at 1.25 to 1.35c. Plates continue somewhat firmer, with no sales of importance, though there are prospects of another vessel contract for the near future. In bars one inquiry of good size is noted, but no considerable sales. Local rod mills are making a large output; wire nail production is also heavy, with no improvement in prices thus far. The hardware trade is fairly active, but buying is for week-to-week necessities.

THE CHICAGO OUTLOOK.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

The week has been a quiet one in nearly all lines, and sales have not been very much, if any, larger than they were the week previous. In crude metal a little better business was done, both in Northern and Southern iron. Bars were very quiet, with only small sales. Rail sales were small, and structural material, billets and rods were quiet. In plates and merchant steel a little better business was done. Local dealers still feel encouraged over the outlook, and say that they expect a considerable increase in both the number and size of orders in the next few weeks.

PIG IRON.—Local iron has had a good sale in small lots, but there were no orders of any considerable size taken. The total of business done, however was a little larger than that of the week previous, and as there are some good inquiries in the market, it is likely that the present week will show some good orders closed. Prices are still made at our quotations, and are quite firm. Southern iron shows quite an increase in orders, several good sized sales being made in the past week. Quite a good carload business was closed also, and altogether the week is about the best one the Southern dealers have had for some time. There is still a good inquiry, and it is probable that several orders will be taken this week. At the same time prices are weak, and sales are being made at the quotations we give, which are lower than those of last week. A rather better trade is reported in Lake Superior charcoal. One sale of 250 and two of 300 tons are reported together with several smaller ones at prices ranging from $13 to $14.50. The demand for Ohio irons has fallen off a little, and only small sales have been made. Our quotations are now as follows:

Lake Sup. Charcoal	$13 00@14 50	South'n Silveries No. 1.	$11 50@11 75
Local Coke Fdy. No. 1	10 25@10 50	South'n Silveries No. 2.	11 25@11 50
Local Coke Fdy. No. 2	10 00@10 25	Jackson Co. Silveries	15 00@16 00
Local Coke Fdy. No. 3	9 50@10 00	Ohio Silveries No. 1	14 00@14 50
Local Scotch Fdy. No. 1.	10 75@11 00	Ohio Silveries No. 2	13 00@13 50
Local Scotch Fdy. No. 2.	10 00@10 50	Ohio Strong Softeners	13 00@13 50
Local Scotch Fdy. No. 3.	9 50@10 00	Alabama Car Wheel	17 50@18 00
South'n Coke No. 1	11 00@11 25	South'n Charcoal No. 1.	15 50
South'n Coke No. 2	10 00@10 25	South'n Charcoal No. 2.	14 50
South'n Coke No. 3	9 75@10 00	Malleable Bessemer	10 50@11 25
Southern No. 1 Soft	10 00@10 25	Coke Bessemer	11 25@11 50
Southern No. 2 Soft	9 75@10 00		

BARS.—Inquiry has fallen off again, and in the past week only a few small sales were made. Prices are still very weak, and are made as follows: Common iron, 1c.; guaranteed iron, 1.10c to 1.15c.; steel bars, strictly billet stock, 1.20c. to 1.25c. The meeting which was to have been held last week at Cleveland, to inquire into ways and means of raising the price of bars by all the mills to something like a paying figure, was abandoned because of the inability of those in charge to get the Ohio mills interested, and nothing has been done that will have any effect on the market, so far. It is hardly likely that any success will attend the efforts of those who have the matter in hand, owing to the indifference of some of the largest mills.

STRUCTURAL MATERIAL.—The contract for the bridge over Twenty-third street in the track elevation plans was let last week, and it is probable that this will be the last one to be let this season. The three bridges over the drainage canal, for which bids were called several weeks ago, are still not let, but it is likely that they will be in the present week. Aside from these there is a fair demand for bridge shapes, and building shapes are very quiet. Prices are unchanged from our last report: Beams, 1.45c; plates, 1.45c; angles, 1.40c; tees, 1.65c. Small lots from stock sell for from ¼c to ½c higher.

RAILS AND TRACK SUPPLIES.—No large business has come up in the past week, and sales made were small. Prices are as last reported: Rails, $25 to $27; splice bars, 1.25c to 1.30c; track bolts, 2c. to 2.10c; spikes, 1.75c. to 1.80c.

BILLETS AND RODS.—There is no change in the situation, and no sales were made of either billets or rods. Prices are nominally $18 for billets, and $25 for rods.

PLATES.—Some good sized orders for mill shipment of boiler and tank steel were received last week, and there is a better demand for bridge plates. Prices are still unchanged: Tank steel, 1.40c to 1.50c; flange steel, 1.65c to 1.70c; firebox steel, 1.75c to 5c; boiler tubes, 75 per cent. discount.

MERCHANT STEEL.—Business is still quiet, and there is no probability of its getting better for the next few weeks. Prices remain as last quoted: Open-hearth spring, tire and machinery steel, 1.75c to 1.80c; smooth finished machinery and tire, 1.50c. to 1.60c.; Bessemer bars 1.40c. to 1.45c.; tool steel, 5.50c to 7.50c.; specials, 11c. and upwards.

SHEETS.—Trade remains quiet, with some good orders closed, both in black and galvanized sheets. Prices are made at 2.35c. to 2.40c. for No. 27 common, black sheets; steel sheets 2.50c., galvanized sheets 75 and 10 and 5 per cent. discount.

OLD RAILS AND WHEELS.—Nothing has been done in this class of material, and prices are only nominal as follows: Old iron rails, $11; old steel rails, short lengths, $7.50, long lengths, $10.50 to $11; old car wheels, $10.50 to $11.

SCRAP.—There is still a good demand for scrap of nearly all classes and good sales were made last week. Prices are made as follows: No. 1 forge, $8.50 to $9.00; No. 1 mill, $7.; No. 1 machinery, $7.50; axles, $13.50; cast borings, $3.50; wrought turnings, $5.00; axle turnings, $6.50; mixed steel, $5.50; heavy cast, $7 to $7.50; stove plates, $5 to $5.25; heavy melting steel, $7 to $7.25.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Pittsburg. The approach of the time of year that usually brings a lull is reflected in market conditions. In Bessemer pig and soft steel there is no disposition to consider propositions for deliveries beyond December and the volume of transactions is reduced to the needs of the immediate future. In Bessemer there has been some buying at $10.90@$11, but billet makers are watching developments and their own light sales and the depressing influence of a short billet interest that has developed makes them hesitate to commit themselves. Sellers of foundry irons have found it necessary to make further concessions lately, 15c to 25c from current quotations being demanded by buyers. A continued moderate demand for forge iron is noted and sales are at $9.65@$9.75. In finished lines the volume of new business is not satisfactory. The lull is perhaps more pronounced. Mills buying billets have been able to purchase at $15.75@$16 for November delivery, and wire rods, barb wire and wire nails show no signs of improvement. In rods very little is done and $22.50@$23 is the nominal range. On beams and channels and plates, Pittsburg mills are maintaining their position in Eastern markets, though some sellers are asking an advance on plates.

Cincinnati. The aggregate of orders for pig iron entered up the past week has been rather above the average of the past few weeks. Notwithstanding this, however, there has been some shading off of prices. In Southern irons there is a noticeable increase of product

due, not so much to the blowing in of new furnaces as to the remarkably large output of those in blast. The furnaces at Ensley, South Pittsburg, Cowan and Bessemer are making a record that a year ago would never have been thought to be attainable. This is due principally to the improved quality of the fuel and ores as delivered to the furnaces. Consumption is maintained fairly well throughout the country, and yet is disappointing to those who looked for steady improvement. The general tone of business for ten days past has not been as hopeful as it was early in the month, but the course of improvement in the past has always been irregular and jerky. It is quite probable that until the November elections, business of all kinds will suffer.

Buffalo. In a quiet way considerable business in pig iron has been transacted during the week, although a number of pending orders have been hung up by buyers desirous of watching the course of events a while longer. On the part of consumers there is an effort being made to create an impression of weakness, but producers tributary to the Eastern market, having small stocks on hand, do not share the feeling and are not pressing for sales. Some of the popular Northern brands are decidedly scarce, but Southern iron seems in abundant supply and looking for business.

MARKETS FOR AMERICA'S SURPLUS.

The returns of our foreign commerce for September showed a decrease of some $13,000,000 in the value of the exports as compared with September of last year. Of this fact a great deal has been said in certain quarters, and attempts have been made to draw inferences not at all warranted by the facts in the case. The greater part, nearly ten millions, of this decrease was due, as the returns show, to the lighter exports of grain and flour, which were the result in large part of temporary causes, a larger supply abroad and the prospect of lighter crops here; in part, however, this decrease must be attributed to causes which are deeper seated and promise to be more permanent in their results. For many years Russia was our only formidable rival in the grain markets of Europe, and her competition was limited by her insufficient means of transportation and by the superior quality of our own product. In recent years, however, the extension of railroads in India and the rapid settlement of the Argentine Republic have opened up sources of supply from which wheat can be furnished at lower prices than our farmers can well afford. Moreover, the Russian railroad system has been much extended, and the exports of that country are growing. The recent completion of the Siberian railroad to Omsk alone opens up to settlement and cultivation a vast area of the black lands of the Kerghiz Steppes, which are fully equal for wheat and rye growing to our own praries of Minnesota and Dakota. All signs indicate that both the amount and the price of our grain exports are threatened with permanent reduction.

It is a fact, however, that the capacity of this country for production is in excess of its consumption, and that this excess is likely to increase rather than diminish. It is well, therefore, to consider how we can offset a reduction in the value of our grain exports, and in what form we can market our excess of production to the best advantage. The loss of a part of our export trade in grain and other raw products is not by any means an unmixed evil, especially if it turns attention in other directions where this loss may be made up.

The true profit of a country is found, not in sending abroad its grain and oil and ores or raw metals, but in exporting the finished products, the work of its skilled artisans. Each additional stage through which the material is advanced is a gain to the country, furnishing additional employment to labor and additional profit to the manufacturer. The cheap and abundant supply of raw material is an advantage of the greatest importance if that supply is utilized as it should be, but it is of little gain if the manufacturers' profit is left to others. We have this supply in greater profusion than any of the other nations in the world, and we have also a supply of skilled labor which is not excelled by any other nation. In nearly all classes of manufacture the productive power per unit of labor is higher here than in any other country; while the quality of our work and our ability in design are shown by the fact that by far the greater part of the labor-saving machinery in use in civilized countries had its origin in America. Keen as competition is everywhere in the present day, we may be fairly said to stand in the position of "the most favored nation." if we only take proper advantage of that position.

Our superiority in mining and metallurgical machinery and methods is hardly contested, and in many cases is frankly admitted by the final test of imitation and adoption. There is no reason now why our manufacturers should not furnish machinery to the world, instead of confining themselves to a single market and permitting others to build from their patterns. We recently referred to the great field for mining machinery exports open to us in the Australasian colonies; but we do not find there our only opportunity. Nearly all the mining countries of South America, where work is still largely done in the old Spanish fashion, present excellent openings. The South African gold fields are already our customers, and an important extenston of their demand is probable from the opening of the so-called "Deep Level" mines on the Witwatersrand, which has just begun, to say nothing of the possibilities of the new opening of the ancient gold fields of Mashonaland and Matabeleland. These are only part of the list which could be given.

There is another point to which a reference may not be out of place here, though it is outside our special field. We are paying out great sums—probably not far from $35,000,000 yearly—to other nations for transporting our products. At the same time we are producing in greater quantities than any other nation the raw materials for ship-building. The change cannot be made, of course, in a year, but there is no good reason why the large sums now paid to England, to Norway and to Germany as freight money should not in time go to our own people. Our Paris correspondent recently quoted, in friendly admonition, the saying of a famous economist: "No nation ever was, or ever can be, commercially rich and great which does not carry its own goods abroad in its own bottoms." This admonition is timely, and we would do well to consider and act upon it.—[Engineering and Mining Journal.

THE Prentiss Tool & Supply Co., 59 South Canal st., Chicago, report a considerably better trade in their class of goods, and have made some very good sales lately. One of the largest sales made by this house in the past few weeks was for the complete equipment of a machine shop for the manufacture of novelties in metal goods, which took altogether about 25 tools. Among these were a Cincinnati milling machine, and Prentiss lathes, drills, shapers, etc. This company have also recently supplied a complete outfit for a machine shop which will be used for large repair work and general jobbing. This equipment included a Pond planer, a large lathe, drill, milling machine, radial drill, shaper, small lathes, etc. They have also supplied the Chicago, Iowa & Dakota R. R. Co. with an equipment for their new machine shop, including lathes, planers, drills, bolt cutters, etc., and the Buckeye Mfg. Co., of Anderson, Ind., with a large Prentiss lathe and special Bickford radial drill, besides a large lot of single orders for both large and small tools. Altogether the Prentiss Tool & Supply Co. report a very good business, and say that the present inquiry for machine tools is very much better than it has been for some time, and that they expect the business in the near future to show considerable increase in size and number of orders.

Hippolyte Hardy has filed a bill in the Circuit Court of Chicago asking for a receiver for the Orvis Steel Arch Furnace Co., of that city. The complainant holds a judgment of $7,520. The assets of the company are said to consist chiefly of patents granted to O. D. Orvis, the president, on downdraft furnace and steam boiler apparatus.

THE Garden City Sand Co., Security Bldg., Chicago, report a very good business in foundry supplies, and say that their sales of foundry sand in the past two or three weeks have been very much beyond their expectations.

THE IRON TRADE REVIEW

DEVOTED TO
IRON AND STEEL MANUFACTURE, FOUNDRY AND MACHINERY TRADES, IRON ORE PRODUCTION, TRANSPORTATION, AND GENERAL INDUSTRIAL PROGRESS.

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A NEW ERA IN STEEL-MAKING.

Attention was called in these columns one week ago, to the drift of Bessemer pig iron production the past year, into the districts in which lowest costs are achieved. It was shown that statistical returns tally with what has been inferred from the activity of furnaces nearest Lake Erie ports since the depression set in: that a lower and lower price basis has resulted in a marked decrease in Bessemer pig production east of the Alleghenies, with much enlarged output in the districts of Eastern Ohio and Western Pennsylvania.

Turning now from the history which has been made in the period of lowest values for Bessemer pig and for all steel products, it will be profitable to take up some considerations bearing on the future of steel-making, and particularly as related to the area of most economical production.

It is not a new idea, that with a thoroughly modern mill steel can be made on the southern shore of Lake Erie at a lower cost than at any other point in the country. But up to this time the development of the steel making industry has been largely controlled by other considerations than proximity to ores. Moreover, the pre-eminence of Lake Superior ores, both in quality and quantity, is a matter of comparatively recent demonstration. The foundations of Pittsburg's greatness as a steel center were laid before lake ores had become even an important factor in steel production. As recently as 1878 the total production of Lake Superior mines was but a trifle over a million tons. And in the census year 1880, only 14 years ago, Pennsylvania's output was 1,951,495 tons of ore, against 1,908,745 tons by the two Lake Superior ranges discovered up to that time.

It is only within a few years, too, that the cost of the long lake haul on Lake Superior ores has reached any close approximation to that of the short rail haul from Lake Erie ports to the furnaces of Allegheny country. In 1880 the contract rate on ore from Marquette was $2.75 to Lake Erie port; from Escanaba in the same year it was $1.85. In the past two years, the average cost of bringing a ton of ore from the head of Lake Superior has been less than the freight from Lake Erie port to Pittsburg, while in the same time, in the case of ore from Marquette and Escanaba, the lake rate has averaged but little more than half the $1,05 paid from lower lake port to Pittsburg furnaces. Thus, while the rapid increase in capacity of lake freighters and decrease in the time required for trips have greatly cheapened Lake Superior ores for all consumers, this minimizing of the cost of the long lake haul has continually emphasized the handicap of the practically unchanged rail freight, upon furnaces more remote from Lake Erie.

Taking account of the saving on coke freight in favor of the Pittsburg district, and deducting it from the freight on 1⅔ tons of ore from lake port to Pittsburg furnace and the advantage in transportation is 65 cents on a ton of Bessemer pig, in favor of the lake shore furnace.

A computation was made by experts and submitted to the Johnson Co. early in the present year, showing that Bessemer pig could be made at Cleveland for $9.21 a ton. This was for 2,300 pounds, casting house weight, with a coke allowance sufficient to smelt a ton of foundry iron, and with liberal allowance for renewals, reckoning labor at $1.00 a ton, standard Bessemer ore at $2.75 and coke at $1.00. That this showing of economy was fully borne out by careful investigation appears in the decision of the Johnson Co. to locate on the south shore of Lake Erie, against its own preference, and with flattering inducements held out to go to points close to the coke supply.

The erection at Lorain, of the six blast furnaces provided for in the Johnson Co.'s plans means the inauguration of a new era in steel making, an era in which economies of location will be joined to the economies of an equipment embodying every new device to lower cost, and the additional economies of buying at farm land prices and selling surplus land at town lot values. The Lorain plan not only eliminates the cost of a site from the account but makes the land contribute to the purchase of expensive equipment, to make the processes of the mill automatic to the largest degree. Our reference to the Lorain project in this connection is merely illustrative of the possibilities of the lower lake region. What applies to Lorain applies with equal force to other points east and west of Cleveland. With a moderate outlay, excellent harbor and dock facilities could be secured at a half dozen other Lake Erie points. Cleveland itself offers many advantages in respect to location, with pre-eminent railroad facilities in addition. The great steel plant operated in Cleveland for years exemplifies in its continued prosperity, the foresight of its projectors.

It is taken for granted in what is said above, that Lake Superior ores will be more and more the dependence of steel makers of the United States. Their abundance and cheapness make this certain Today, with the consumption of iron and steel, as of every other product, much below the rate of average prosperity, the use of Lake Superior Bessemer ores is at a rate never equalled. The vast deposits of Mesabi Bessemers seem to have been hit upon none too soon to fit into the new order of lower prices and narrower margins. Their cheapness is already stimulating furnacemen to the adoption of methods that will increase their percentage in Bessemer mixtures. Nothing is plainer in the statistics of the past 18 months than that the furnaces using Lake Superior Bessemer ores are gaining in their percentage of the total output of Bessemer pig while there is a falling off in the output of those supplied with ores from other sources. And as consumption has been expanding it has been noticed that the inactive furnaces in less favored districts have not been brought into line to supply the demand, but steady additions have been made to the list of producers in the area of lowest costs.

Another consideration that had much weight in deciding the Johnson Co. to move to Lake Erie was accessibil-

ity to important consuming centers. The south shore of Lake Erie is a great highway, over which passes every year a large share of the country's east and west traffic. In the very heart of the region comprehended by the Central Western States, it lies midway between the country's metropolis on the seaboard and the metropolis of the west. The east and west lines that traverse Northern Ohio are frequently crossed by roads leading into important consuming districts—districts in which population has rapidly increased in the last two decades. The census of 1890 showed that the cities on Lake Erie of 8,000 inhabitants and over had grown in population 60 per cent. in the preceding ten years—the expansion being due in large part to the marvelous increase of the traffic of the Great Lakes in that period. This prosperity was shared also by the region tributary to Lake Erie, through which passed a large proportion of the freight borne up and down the lakes. The coal fields of Ohio and Pennsylvania send millions of tons annually to Lake Erie docks and the north and south lines tapping these fields carry back other millions of tons. No other section of the country is more closely webbed with steel tracks or more thickly set with manufacturing establishments working up iron and steel into varied forms of finished product. Thus steel works on the lake shore have their customers almost at their doors.

In the years of prosperity preceding 1893, the various town-booming schemes that flourished, particularly in the districts finding natural gas, were effectual in securing a very respectable migration of Eastern concerns to the West. Low fuel cost and cheap or absolutely free sites, added to nearness to the Western trade, were irresistible arguments even in the days of good prices, comfortable margins, and the full employment of producing capacity. Now that so much manufacturing equipment is unemployed, the possession of competitive markets will hinge more and more upon the ability to achieve bed-rock costs. And as demand increases, it may be expected that the facilities of the most favored producers will be expanded to take care of it, rather than that unfavorably located plants will return to their former pace. No such advance in prices is expected, as will give these plants all their old markets.

Eastern industries, consumers of raw steel, are already looking in the Central West for locations that will put them on a footing with Western competitors. They are realizing that the steel industry will find its most economic development in a district closest to Lake Superior ores, and affording at the lowest cost a meeting point for lake ores, the limestone of the Marblehead Peninsula and the coke and coal of near-by Pennsylvania and Ohio points. They appreciate the fact that in getting near to steel producers having such a location, they are secure against any shift in the producing center, and that whatever changes occur will only emphasize the advantages of their new position. Not only are consumers of steel investigating this question, but we have reliable information that a project quite as bold in its conception as that now being evolved at Lorain has a lake shore site under serious consideration.

Of negotiations in this direction more might be said were they farther advanced, but it is evident that the importance of the movement now going on is appreciated. The situation is being closely studied by the great producing interests, and on all hands it is recognized that the next twelve months will bring developments of era-making significance.

A MUCH NEEDED REFORM.

A meeting of bar iron manufacturers and jobbers in Indiana, Illinois and the St. Louis district was held at Indianapolis early in October, with a view to freeing that trade from some of the bad habits that desperate competition has fastened upon it. With the expectation of enlisting the co-operation of the important mills located in Ohio a further appointment was made for Cleveland, Oct. 23, but no meeting was held, for the reason, it is reported, that valley manufacturers did not take part in the movement. There is no doubt a sincere desire throughout the Western bar iron trade for a change in existing methods of doing business. Mills and jobbing houses have seen one concession after another given to the buyer, until there is left neither profit nor satisfaction in any regard. The day of full extras went long ago, and half extras are being waived in so many instances that the distinction between base and special sizes is being rapidly broken down. Cutting bars at the mill according to customers' specifications, throwing all waste on the mill, is another practice that means just so much reduction in price.

Whether direct or indirect price cutting in the ways referred to can be stopped by meetings and agreements, is a question. The trade is so diversified and so many manufacturers and jobbers are connected with it, with advantages in location and fuel costs so widely differing, that adherence to regulations that might be made would likely prove short-lived. There is one reform, however, on which many in the trade believe unison of action could be secured, and that is a reform in the attitude of buyers toward their contracts. Falling prices and an unwillingness by sellers to go to law to enforce contracts have begotten in some buyers a light regard for engagements. Having agreed to take a certain amount of material at a given price, within a given time, they seize on every occasion for refusing to take out iron if meantime there has been a drop in the market price. In some instances the strain is such that no quibble or indirection is resorted to, and the flat-footed declaration is made that the market is lower and unless the contract price is reduced correspondingly no more material will be received. If the seller insists on the contract, relations are severed, and another mill or jobber supplies the buyer at the lower ruling price. Nor are mills entirely exempt from responsibility in this regard. It is a fact that in their eagerness for orders some sellers have even suggested these contract repudiations, notwithstanding the certainty that at no very distant day they will encounter the very same situation with which they have embarassed a competitor. And when the fowls come home to roost, the concession demanded must be made, or the buyer again transfers his account. It is the countenance given to such practices as these, that has led to exceedingly strained relations between jobbing houses in one Western selling center at least, and assisted in a demoralization that is quite bad enough without any help from the selling side of the market. Since the seller's purchases of raw material are based on the contracts he has taken the tendency is to throw on him the risk of every change in the market, not only of all that he buys but of all that he sells, or thinks he is selling.

The remedy that has been suggested in some preliminary correspondence that has already passed between bar mills, is an agreement among manufacturers and jobbers to report the names of repudiators of contracts and to refuse to sell them until they have fulfilled their engagements. This plan involves no injustice, and its adoption would do much to support the platform of business ethics in a somewhat shaky spot.

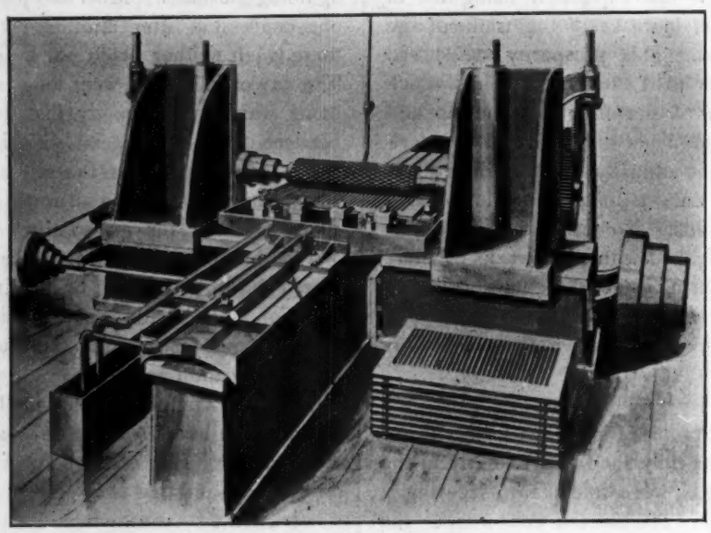
AN ACHIEVEMENT IN MILLING.

An interesting illustration of what may be accomplished in surface milling is afforded just now at the works of the Pratt & Whitney Co., Hartford, Conn. We reproduce herewith views of the machine and the special work accomplished, from photographs taken as the machine was in operation. The work, as will be seen by referring to the illustration, consists in the corrugation of metal plates by milling, using gang mills and finishing a plate at one cut.

These plates are of steel ¼-inch thick, 24 inches wide and 40 inches long. The corrugations are formed of arcs of circles of $\frac{9}{16}$ inch radius and cover a surface of 20 inches wide by 33 inches long and milled to the depth of $\frac{5}{32}$ of an inch, requiring a gang of mills 33 inches in length to do the work. Spencer Kellogg, of Buffalo, for whom this work is being done, uses in the manufacture of a certain product about 1,000 of these plates and so great has been the need of them that it has been necessary to work 24 hours per day, using double sets of mills to avoid the loss of time consumed in grinding.

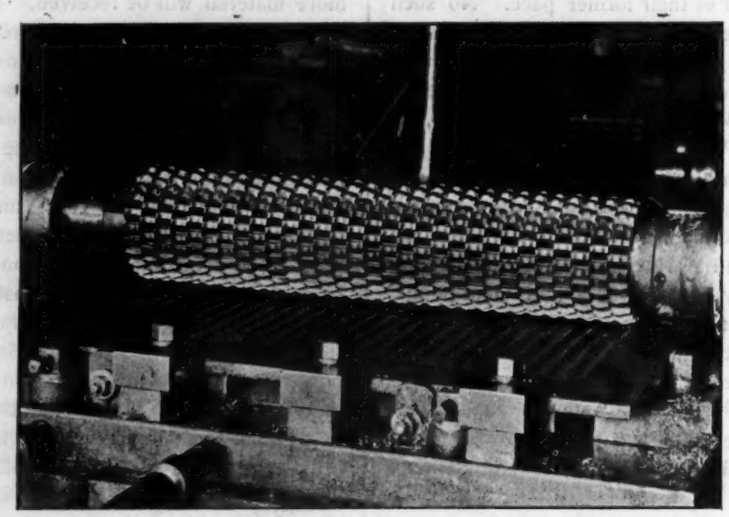
The manner of making these mills will also be of interest. One set is made up of 30 separate pieces each eight inches in diameter, 1⅛ inches wide and four inch bore, the faces of each being ground so that the joint will show as little as possible on the milled surface. In the other set there are four mills only or four blocks. Two of the blocks contain nine each of the corrugations, one eight and one seven, making the same number as the former set and being the same dimensions otherwise. They are interlocked, forming in effect a solid mill 33 inches in length, eight inches diameter and leaving a surface absolutely smooth. The cutting edge of each row of teeth in the blocks is set far enough back of the teeth in the preceding one so that only one block or eight mills are cutting at one time. The plates are milled at the rate of about one an hour, including changing, and the mills being kept well lubricated run from six to seven days without grinding.

The machine in which these mills are operated, shown in the illustration, is built by the Pratt & Whitney Co., and known as No. 7 double head power miller. It is probably the only machine built in this country capable of doing this work. It was designed and built to meet the requirements of just such work. It is made with either single or double head and there is provision for driving both heads together or separately, as is necessary. The table is driven by a large and extra long worm gearing with rack on under side. This worm is in halves and is adjusted for taking up wear in threads. It has ball-bearing collars on both ends for taking thrust.



The spindle is of steel with tool steel thrust collars hardened and ground. The front bearings are 11 inches long and 5½ inches in diameter. The greatest distance between centers is 54 inches; least distance, 14 inches. Greatest height center of spindle above table, 25 inches; least height, 4 inches. The table is 20½ inches wide and the length the limit of its travel. The speeds are so arranged as to take cutters from 4½ to 18 inches diameter.

The present work, while not showing the result in cubic inches of stock removed per minute as in milling side rods and like work, is probably the severest test the machine has been put to, owing to the great length between centers and the amount of surface involved.



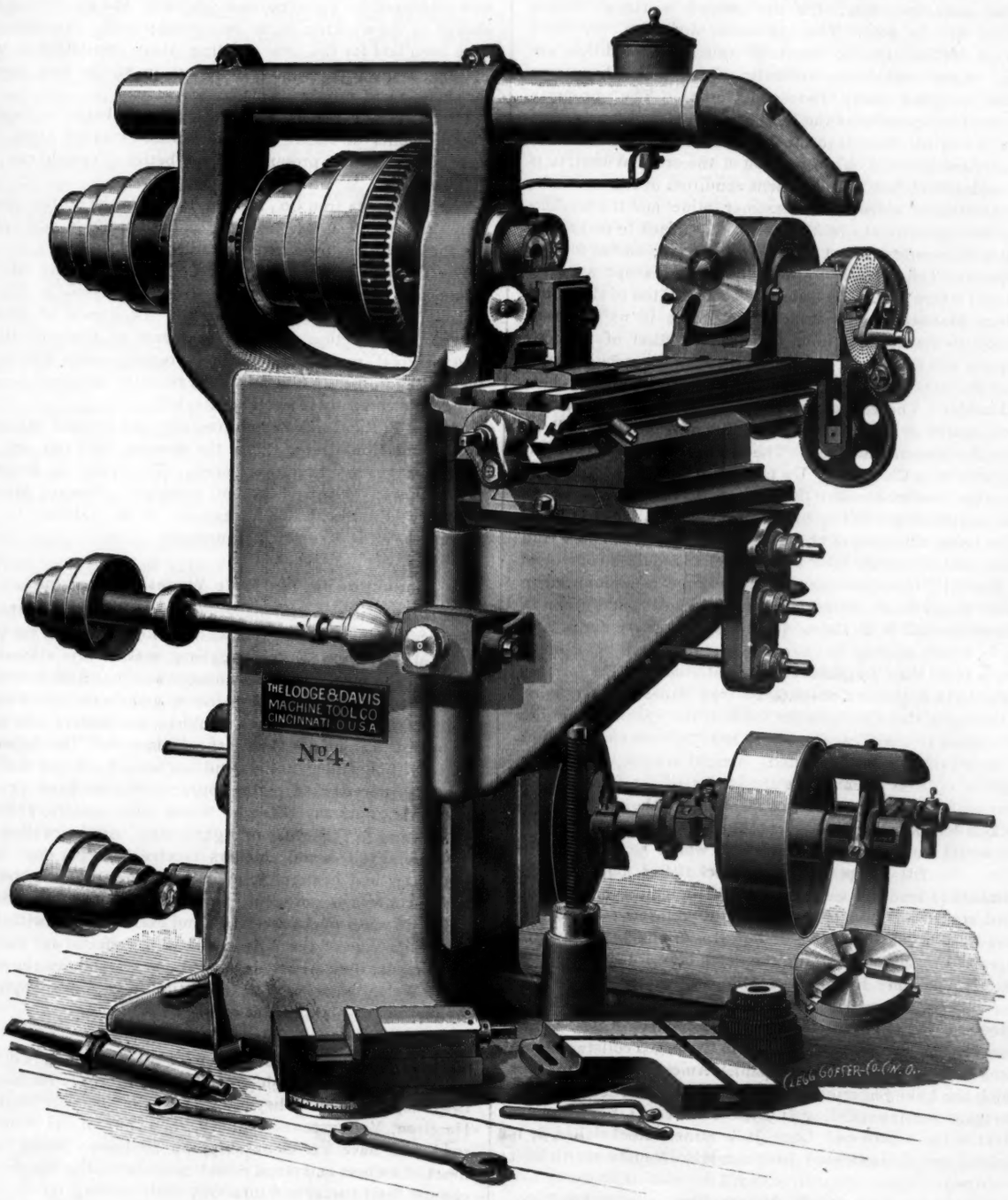
The work has been watched with great interest by mechanics visiting the company's works the past month, and astonishment expressed at the ease with which the work is done, the uniform smoothness of the milled surface and the entire freedom from any evidence of chatter which might be expected in a gang of mills of this length.

INDIANAPOLIS Stove Co. advanced wages 5 per cent.

UNIVERSAL MILLING MACHINE.

The illustration given herewith is of a universal milling machine made by the Lodge & Davis Machine Tool Co., of Cincinnati. Its features are detailed below:

An adjustable overhanging arm is provided and fits in clamp bearings over each spindle bearing, the uprights being independently tied together, as shown. The spindle is of crucible steel, is hollow and runs in phosphor-bronze boxes adjustable for wear. The end of the spindle is threaded to take the same chuck that fits also the spiral head spindle.



UNIVERSAL MILLING MACHINE.

The table has three T-slots running its entire length, and around it an oil channel is formed which catches all oil and conducts it to a drainage tube and suitable vessel which can be attached to it. The foot stock center is adjustable vertically for taper work and the spiral head has the usual adjustments above and below the center line. It is made as compact as possible and is provided with plates for indexing up to 360 teeth. Geers are provided for cutting spirals from 1.5 inches to 66 inches pitch.

The table is fed automatically in either direction at 12 different rates relative to spindle revolution, ranging from .007 inch to one inch, and the feed is reversed by turning the knob seen at the left of the knee. It is automatically stopped by the stud, which is adjustable in the T-slot, and operates in either direction. The lower feed cone is upon a swiveling yoke, which permits it to be adjusted to secure proper tension on both feed belts. The table can also be moved by hand either from the left hand end or from the front of the knee, and it has a quick return motion. The handle by which the feed is thrown, and by which it also may be thrown out if desired, is at the right of the knee.

All traversing screws are provided with micrometer gradua tions, and the dial plates are adjustable, and are held in place by knurled nuts, which are readily loosened or tightened by the fingers. Taper gibs are provided for all sliding surfaces. The machine is provided with all the parts and attachments shown in the engraving.

A MEETING of manufacturers of cold rolled steel called at the instance of the Wilmot & Hobbs Mfg. Co., of Bridgeport, Conn., was held in New York Oct. 24. Several Pittsburg firms were represented. Steps were taken to stop disastrous price cutting.

LAKE SUPERIOR IRON MINES.

The sale of the Chapin mine, under the foreclosure proceedings instituted some time ago was made at Iron Mountain, Mich., on Monday Oct. 29. M. A. Hanna, for M. A. Hanna & Co., bid $88,973.46 and with no competition the bid was accepted. This amount represents the unsatisfied balance of first mortgage bonds, plus the fees of the trustee, court costs, etc. The outstanding first mortgage bonds were held by M. A. Hanna & Co., who acquired them along with a majority of the stock of the Chapin Mining Co. at the time they started up the mine last May. On the second mortgage bonds nothing will be paid. The bid made does not represent the cost of the mine to the new owners; in addition are taxes, recent repairs to hydraulic plant, and other items totaling a good many thousand dollars. The property sold on Monday includes the lease, buildings, and equipment and a two-thirds interest in the Hydraulic Power Co. While the purchase price is only a fraction of the original cost, it is well understood that in the present condition of the ore trade, the operation of a deep non-Bessemer mine and the marketing of the quantity of ore that must be raised to make production economical, is not a play-day contract; and as for the equipment it is practically without value except as it is operated where it is. The sale will be presented to the court at Iron Mountain next Monday and there is no apparant obstacle to its confirmation. The organization of the new company will take in M. A. Hanna & Co. and associated interests. Mr. C. A. Chapin, owner of the fee, is likely to be a stockholder. The capitalization will probably be $500,000—20,000 shares at $25 a share, and the incorporation will be under the laws of Michigan. The headquarters of the company will be in Cleveland. Up to next Tuesday operations at the mine continue under the trustee; on that day shipments cease and stock-piling begins for the next year.

The latest after-clap of the Lake Superior Consolidated Iron Mines deal, by which John D. Rockefeller acquired control of the Merritt properties on the Mesabi range, is announced in Duluth dispatches. Alfred Merritt brings suit against John D. Rockefeller and F. T. Gates, his private secretary, for $1,226,400, in which amount he claims he was damaged by what he alleges to be their fraudulent representations in the forming of the Lake Superior Consolidated Iron Mines. These representations related chiefly to the value of the Spanish-American and Aurora Iron Mining Co. stocks held by Rockefeller, which he turned into the Consolidated. Merritt alleges that putting in these outside stocks made the stocks of the Consolidated decrease to $10 per share of $100 face value, although he claims Rockefeller had said that the consolidation of all these interests would make Consolidated stock worth 50 cents on the dollar. Merritt alleges also that Rockefeller and Wetmore promised to lend him 40 cents on the dollar of his Consolidated stock, but that later Rockefeller refused to lend him more than 10 cents on the dollar. In organizing the Lake Superior Consolidated Mines, the defendant, it is claimed, got the new company to take the following interests owned by him: 28,350 shares of Aurora Iron Mining Co.'s stock, 865 shares of Penokee & Gogebic Consolidated Mines, 21,626 shares Spanish-American Iron Co. in Cuba, 300 collateral trust notes of $1,000 each of the Spanish-American Iron Co., for which the Lake Superior Consolidated Mines turned over first mortgage bonds exceeding $1,900,000. For a 51 per cent. interest in the Adams and Lone Jack mines, Rockefeller, it is claimed, got Consolidated first mortgage bonds worth over $1,700,000.

On Saturday, Oct. 20, the Metropolitan Iron & Land Co., started shipping from No. 7 stock pile of the Norrie to the docks at Escanaba. Twenty-five thousand tons is the amount that will be sent to Escanaba by the Metropolitan before the close of navigation. If winter holds off a few weeks longer, very little stockpile ore will be left on the Gogebic Range. —[Ironwood News Record.

Ashland shipments of iron ore last week were 44,152 tons; for the season, 1,449,663 tons.

At the Pewabic mine in Iron Mountain, Mich., a cave-in occurred Oct. 25, caused by settling in an old room 100 feet high above the third level. The sandstone capping overhanging the room came away with sufficient force to crush the supporting timbers. One man was killed and 11 were imprisoned. In the work of rescue 30 feet of timbers, rock and ore had to be tunneled and new timbers placed to prevent another cave-in. Forty hours were required for the rescue. All in the mine were taken out alive.

At the Morgan and Pascoe pits of the Republic mine, work has stopped and 80 men are out of employment. The rapid exhaustion of the ore in this portion of the mine and the high cost of production led to this step. In other parts of the mine work is going on as before.

The total season's shipments from the Norrie mines, including those by rail, will run close to 825,000 tons. There are now employed between 800 and 900 men and no immediate change in the working force is contemplated. Foundations have been laid for the new hoisting plant, consisting of two ten-foot drums, that is about to be put in at the East Norrie for shafts 2 and 3.

The Wisconsin Central Railroad will soon begin extensive improvements on its ore docks at Ashland, making them six feet higher than at present, so that better dispatch can be given vessels.

The Minnesota Iron Co., has not taken up the option given it by the Rouchleau-Ray Iron Co., on the latter's 80-acre tract, but the option has been extended to Nov. 13.

The Chicago & Minnesota Ore Co., a sub-company of the Minnesota Iron Co., has taken from Robinson & Flynn, Detroit lumbermen, a sixty-day option for a lease of Mesabi iron lands in section 34, 58–17 just east of Eveleth, Minn. The original purchasers of this property were Kimberly, Weimer and others. The McInnis, recently acquired by the Minnesota company is also near Eveleth.

Charles F. Rand was elected treasurer and general manager of Ashland Iron Mining Co., at the meeting held Oct. 27. No other changes in officers were made. The board of directors is as follows: Edwin H. Abbot, president; Howard Morris, secretary; Charles F. Rand, treasurer; E. W. Oglebay, C. W. Harkness, W. D. Rees, H. B. Sturtevant.

Reduction in Tin Plate Wages at St. Louis.

In explanation of the reductions recently made by the St. Louis Stamping Co., in consequence of the lowered tin plate tariff, Mr. Thomas F. Niedringhaus makes this statemant: "In order to meet the disadvantages our business will suffer on this account we were compelled to make a reduction in the wages of the rollers, catchers, doublers, and heaters, who number about 200 men. Under the Wilson bill the following wages will be paid: Rollers and catchers, $3.71 per ton, netting $8.35 per day of eight hours; doublers, $2.02 per ton, netting $4.50 per day of eight hours; and heaters, $1.86 per ton, netting $4.15 per day of eight hours. Statistics show that in England rollers and catchers receive $3.76 per day; doublers, $2.23; and heaters, $2.10. Under the McKinley bill we paid our men 150 per cent. more than the workmen in the Welsh tin plate works received, and even now, notwithstanding the passage of the Wilson bill, which effects our business so seriously, they are receiving 100 per cent. above the wages of the Welsh laborer. The reduction mentioned applies to the making of black plates only."

THE Youngstown (Ohio) Iron & Steel Roofing Co. have their new plant thoroughly equipped and ready for business in all departments. They are very advantageously located at Hazelton, Youngstown's suburb, on a spur of the Erie Railroad and have excellent shipping facilities. Being in the heart of an iron and steel sheet manufacturing district, they can get their sheets and turn out their roofing on very short notice. The stockholders of the company are well known Youngstown capitalists and the officers are L. E. Cochran, president; G. M. McKelvey, vice-president; Mason Evans, treasurer; C. S. Pew, secretary and John O. Pew, general manager. General Manager Pew has had a long experience in the manufacture of roofing at Niles, O., and no doubt with his management, the company will achieve great success. They have opened branch offices in New York, Chicago, Buffalo, Pittsburg and Richmond, Va.

PRESIDENT S. S. Curry and Mr. H. S. Hazelton, of the Metropolitan Land & Iron Co., and President Morse, of the Illinois Steel Co., have been in Cleveland the present week

WESTERN FOUNDRYMEN'S ASSOCIATION.

The regular meeting of the Western Foundrymen's Association was held Wednesday evening, Oct. 24, 1893, at Room 701 Western Union Bldg., Chicago. Mr. John M. Sweeney occupied the chair. The following gentlemen were present: Thomas Snow, Challenge Feed Mill & Wind Mill Co, Batavia, Ill.; H. S. Vrooman, Garden City Sand Co., Chicago; E. C. Greenlee, Greenlee Foundry Co., Chicago; F. B. Whitcomb, Chicago; F. W. Sargent, The Sargent Co., Chicago; G D. Chamberlain, Chicago; Wm. M. Wing, Hoyt & Bros. Co., Aurora, Ill.; E. H. Walker, Emerson, Talcott & Co., Rockford, Ill.; L. Wolff, Jr., C. J. Wolff, L. Wolff Mfg. Co., Chicago; C. S. Reed, Chicago Retort & Fire Brick Co., Chicago; John T. Rowland, J. I. Case Threshing Machine Co., Racine, Wis.; Alfred D. Edwards, John Bailey, Illinois Iron & Bolt Co., Carpentersville, Ill.; W. C. Waterbury, Forster, Hawes & Co., Chicago; S. T. Johnston, Whiting Fdy. Equipment Co., Chicago; A. W. McArthur, Rockford Fdy. Co., Rockford, Ill.; O. T. Stantial, Illinois Malleable Iron Co., Chicago; George O. Ware, Sibley & Ware, South Bend, Ind.; Chas. Shepard, William I. Baker, Buda Fdy. & Mfg. Co., Harvey, Ill.; John M. Sweeney, Chicago; E. W. Smith, Crane Co., Chicago; B. M. Gardner, *The Iron Trade Review*, Chicago.

On motion, duly seconded, the following candidates for membership were unanimously elected members of the Association: L. Wolff Mfg. Co., Chicago; C. H. Woodruff Co., Elgin, Ill.; Charles Johnson, of the Howe Scale Co., Rutland, Vt.; Forster, Hawes & Co., Chicago; East Chicago Foundry Co., Chicago.

The secretary then read a paper by Mr. Thomas D. West, entitled, "Comparisons of Strength in Specialty Mixtures of Cast Iron." It will be found in another column.

After the reading of the paper the test bars were passed around among the members present for examination.

DISCUSSION.

Mr. Snow: Mr. West evidently thinks that a ½ inch bar is a fraud, and that all of us have been laboring under a delusion in using them.

Mr. Stantial: He says that a ½ inch bar would show better in stove plate iron than in a harder iron.

Mr. Bailey: Test bars as a rule are better for comparative results than for any other purpose. You may test two bars and one will show great tensile strength while the other will show the reverse, and at the same time there will not be any appreciable difference in the mixture used.

Mr. Stantial: My experience with test bars is as you say. One bar may break at 2,000 pounds, while another of the same mixture will break at 2,200.

Mr. Bailey: You will never find any two sets of bars the same, although the mixture is the same all the way through.

Mr. Stantial: You find the bars in the middle of the heat stronger than those taken from any other part, do you not?

Mr. Bailey: Not always. Those taken from the last part of the heat are sometimes the strongest. The way I account for that is that the specific gravity of the hard iron is less than that of the soft iron. We often find where iron is not melted properly, a stratum of chilled iron in the last part of the heat.

Mr. Wing: My class of work is in machinery castings. We use an old fashioned test bar for getting a comparative test. We get a car of iron this month, and test it. Next month we get another, and test it to find if it is equal to the grade of the last car. We have always been satisfied with our tests.

Mr. Sweeney: What sized test bars do you use?

Mr. Wing: I think 1¼ inches square at each end, and turned down ½ inch in the middle. We twist it off with a 5 ft. lever. We think it ought to give a good comparative test in comparing one car of iron with another in regard to strength.

Mr. Sweeney: I suppose there is no question as to comparative test but it gives you no data. That is the prime object of test bars. The nearer the test bar corresponds to the characteristics of the casting the more valuable it is. I think Mr. West has prepared for that phase of the subject when he remarks that he expects later to present another paper on this subject of test bars. The difference between a test bar cast in green or dry sand seems to have a considerable bearing on the subject when it comes to the comparative strength.

Mr. Walker: We are using the Riehle Bros. testing machine and test two pairs of bars. Of course these bars vary, but we get a very good test. They are square bars cast flat, and there is not a difference of two hundred pounds in any week's test. They are 12 inch centers and they have not varied 200 pounds in the last two weeks. We take the bars, one at the third tap and the other at the last half of the heat, and the last bar is the stronger.

Mr. Stantial: How do you account for it?

Mr. Walker: I have no theory.

Mr. Snow: Mr. West makes the assertion that the round test bar is about the right thing and gives some reasons why the square bar is not as good as the round.

Mr. Stantial: The tests seem to show that the round bar is more regular than the square, and that ought to seem natural at the first glance, as in the square bar there are four corners that are subject to flaws and changes, and this would not be true with the round bar.

Mr. Shepard: The surface area is different as well.

Mr. Wolff: We take test bars with one inch square bars. We cast our bars from the top. That is, we pour the iron right into the top of the bar and cast them upright, and as a rule get a very good class of iron free from flaws. The bar is made long enough so that the two inches at the top does not need to be included in the test.

Mr. Shepard: Have you ever observed that a casting containing a flaw in the fracture would sometimes be better than one without the flaw?

Mr. Walker: I have had that experience twice. In one instance the bar was exceptionally strong.

Mr. Wing: I have invariably found a bar poured hot stronger than a bar poured cold. To quite an extent more than we could account for

Mr. Rowland: I can say this in regard to my experience with test bars; that the hotter I pour, the greater the strength every time. I have had some arguments on that point with a brother foundryman. He claimed that the one he chilled was the strongest. At last I convinced him, and he found the hotter he poured it the greater the strength. I find it invariably so. I have found as much as 200 lbs. difference in iron poured out of the same ladle.

Mr. Bailey: I have found it so also.

The Secretary read an article by Mr. Alexander Cairns, of Detroit, criticising Mr. West's system of test bars, and Mr. West's reply to Mr. Cairns, both taken from the *American Machinist*.

Mr. Wing: What sized bar is used most now?

Mr. Stantial: Twelve inches between supports is the most popular, but I am using a two-foot bar. If the two-foot bar breaks in a flaw, I have a foot bar left for the test.

Mr. Wing: Then you would record two tests?

Mr. Stantial: Yes, with the same bar.

Mr. Wing: We had a peculiar experience. One day the test bars ran about 300 lbs. lower than the day following on the same mixture and at the same temperature.

Mr. Shepard: Perhaps the cupola was not working right.

Mr. Sweeney: Foundrymen have not gone far enough to account for these differences. There must be some reason for them.

Mr. Vrooman: Would it not be a good plan to weigh the bars and see if the difference in weight would not be the cause?

Mr. Stantial: Mr. West says the conditions should be the same in the two bars.

Mr. Shepard: At the same time you know by experience that two similar bars will break at different weights.

Mr. Sweeney: I have used test bars in my practice for a great many years and have found them very valuable. I can see where the work is the same each day, the value of the test bar dissapears to a great extent. Test bars are valuable and it pays to use them, and it pays to carry out the system. In one class of work a test bar may be of greater value than in another class.

Mr. Stantial: My experience has been that the test bars vary, and I would not want to buy iron by the result of test bars.

Mr. Bailey: I am governed every day by test bars.

Mr. Sweeney: When you add a laboratory to your test bar business, you will be all right. That is one thing I am anxious to see as a result from this organization. It will accomp-

lish a very great good to all persons who handle cast iron or melt it in cupolas.

Mr. Rowland: I always use a test bar in my practice, as it tells better than anything else whether the cupola man is doing his work all right or not. Every time I can catch him on the test bar.

Mr. Shepard: What reason have you to account for the fact that the middle heat gives the greatest strength?

Mr. Walker: I do not know. I have no theory. It is simply a matter of my experience. The test bar taken from the first or second tap is generally the weakest, and the test bar taken from the end of the heat is generally weaker than that taken at the middle.

Mr. Stantial: I had an experience of over two years in making square test bars. We took four test bars in a heat, and invariably the first bar was from 200 to 400 lbs. weaker than the following bars.

Mr. Sweeney: Did you use scrap in these charges?

Mr. Stantial: Yes, there was some scrap used.

Mr. Sweeney: What was its character, light or heavy?

Mr. Stantial: It was first class machinery scrap.

Mr. Sweeney: Is it possible that the scrap could have come down first and in that way affect the test bar?

Mr. Stantial: It would seem more that it was the lining in the cupola, or the lining of the ladle, or something like that. I have never studied to find out what was the cause.

Mr. Shepard: You never poured the first iron into the best work, did you?

Mr. Stantial: No. At that time we used to favor the first charge. If anything, I would make a better mixture for the first charge than for any other charge.

Mr. Shepard: Do you not think you get more sulphur in the last end of the heat?

Mr. Stantial: I have taken the stand before, that we get more sulphur in the first part of the heat, through the bed. I have followed that up by chemical analysis and found I was right.

On motion, a vote of thanks was extended to Mr. West for the paper of the evening.

The meeting then adjourned.

The Mechanical Engineers' Test Bars.

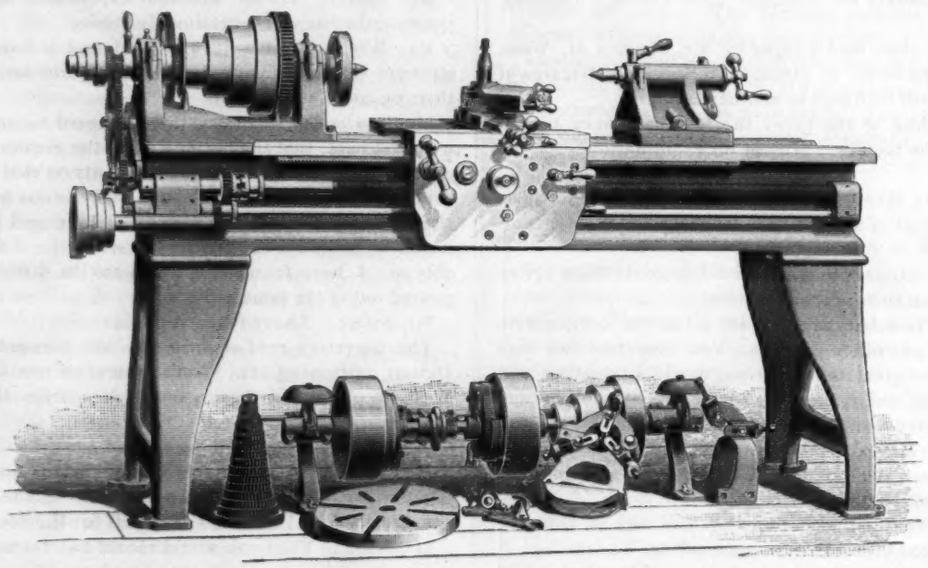
It will interest the readers of *The Iron Trade Review* to know that the four tons of test bars made by Mr. Keep for the Committee on Standard Tests of the A. S. M. E., are being tested by Prof. R. C. Carpenter, of Cornell University, and by Prof. C. H. Benjamin, of Case School of Applied Sciences, Cleveland. A full chemical analysis of each set of test bars is being made by R. N. Dickman, of Cleveland, and by Dickman & Mackenzie, of Chicago.

THE Sheffield Land Co., the real estate side of the new Johnson Co. enterprise at Lorain, O., has sold 200 lots at the steel plant. Work is in progress on 100 houses.

IMPROVED 14-INCH ENGINE LATHE.

The illustration herewith shows an engine lathe that has all the good features of the ordinary machine, and in addition several valuable features of its own. The spindle is made of high grade special steel, runs in boxes made of the best phosphor bronze, and is $1\frac{1}{8}$ inch hollow clear through. The headstock is massive, webbed its entire length, and is not weakened to make room for reverse plate, as none is used. All feeds are reversed in the apron. With the patent geared rod feed which is positive, all feeds are obtainable within the range of modern practice, and without using the lead screw. Length and cross feeds are graduated to 64ths or 1,000ths of an inch Tail stock set over is graduated. Chasing stop is made very solid, is graduated to 1,000th part of an inch, and can be set at zero in any position, so that screws can be finished and fitted without removing from the lathe and duplicated to an exact fit. The tool cuts threads 5 to 48 per inch without changing gear on spindle, by using a telescope gear.

The carriage has a bearing on each of the four V's, and is locked for cross feed work by an eccentric clamp from the front, which performs the work without any side strain or twist, such as a gib tightener produces. The feed rod and lead screw run in bronze bearings. The apron is so arranged that it is impossible to throw in the rod and screw feeds at the same time. The lathe is furnished with either plain block, or rise and fall rests, also with taper attachment if it is so desired. The countershaft has patent friction pulleys, 10 inches in diameter and 4 inches wide, and should run 160 revolutions per minute.



IMPROVED 14-INCH ENGINE LATHE.

The measurements of the lathe are as follows: swings over ways, 14½ inches; length of bed 6 ft. 8 in.; turns between centers 3 ft. 1 inch; weight, 1,400 lbs.

This tool is for sale and is kept in stock by Messrs. Dawson & Goodwin, dealers in machine tools, 57 S. Canal st., Chicago.

THE production of the German blast furnaces for the month of August is given by *Stahl und Eisen* at 489,211 metric tons, an increase of 12,317 tons over the output for July, and of 68,262 tons over that for August 1893. The total number of furnaces in blast was 138, giving an average output per furnace for the month of 3,545 tons. Of the production this year 133,266 tons were classed as forge iron, 79,456 tons as foundry iron, 37,023 tons as Bessemer iron, and 239,466 tons, or very nearly half the production, of Thomas iron. The large proportion intended for the conversion into steel by the Thomas Gilchrist process, and the small amount of Bessemer iron, are notable points in the report. For the eight months ending August 31st the total output was 3,615,176 tons, an increase of 378,496 tons, or 10.5%, over the corresponding period of last year.

A RECEIVER was appointed Oct. 27 for the Hercules Foundry Co., soil pipe, Anniston, Ala.

COMPARISONS OF STRENGTH IN SPECIALTY MIXTURES OF CAST IRON.*

BY THOS. D. WEST.

This paper is a report of the writer's labors for the past four months as a member of the Western Foundrymen's Association Testing Committee and is tendered to Mr. O. T. Stantial, chairman of the committee.

This report presents a series of about one hundred tests on the strength of cast iron mixtures such as are used for gun metal, chill rolls, car wheels, heavy machinery, light machinery, stove plates and sash weights, a list which can be seen to cover very nearly all mixtures necessary to cast iron founding.

The writer's objects in presenting this series of tests are: First to illustrate the fact that by casting test bars on end, we are using the best possible method to obtain the natural strength of an iron, hence more uniform results and satisfactory comparisons, that are not attainable by casting test bars flat; second, to exhibit the desirability of using a round test bar as against the square bar in assisting to lessen erratic results, attain the iron's best strength, and afford the best means to make comparison between rough round and turned test bars; third, to prove the impracticability of using a half inch square test bar to obtain any knowledge of the natural or relative strength of cast iron, or figure its value per square inch.

Each foundry, in casting a set of these test bars from the patterns which the writer furnished, made three ½″ square, three 1″ square, three 1⅛″ in the rough and three 1⅛″ urned. These 1⅛″ round bars in the rough and turned are of an area as nearly equal to one square inch as it is practical to make them. The turned bars were cast with a swell on so as to measure about 1⅝″ in diameter for about four inches of their length in the center. This swell was turned down until the bars measured close to the size of their companion 1⅛″ rough bars. The comparison between the rough round and the turned bar enables us to perceive the difference that may exist between the strength of the iron with its surface affected by the walls of a green sand mold and that of iron having its rough surface turned off.

It was first planned to have all these test bars cast on end, so as to afford the most favorable conditions to insure solid bars, etc., but in starting with car wheel mixtures, difficulty was found in getting the half inch square test bars to "run," and as there were other strong irons I desired tests from, I changed the plan of casting and had all bars cast flat with an incline of two inches, the pouring gate being the high end. The three test bars from each of the four sizes were cast all in one flask, poured from the same gate, and out of the same ladle. Each test bar had two wires cast in it, one foot apart, for measuring contraction and to be a guide in always placing the test bars the same way in being tested. While it is to be regretted that the bars tested for this paper were not cast on end, still the principles involved have not been sacrificed in any wise and the object of the paper is served as well for the end desired.

These test bars were cast by some of the most prominent foundry specialists in this country. They are not a crucible melt of estimated mixtures or of a special heat, but are taken from regular heats "run" for making castings in the specialties herein mentioned, therefore represent the strength of the actual metal used in actual practice for the manufacture of the castings outlined as far as is practical with bars cast flat. I now have a complete chemical analysis (made by Mr. W. A Barrows, Jr., of Sharpsville, Pa., a chemist of large experience) of the various mixtures or specialties, for publication in my coming work "Studies in the Science of Mixing and Testing Cast Iron," in connection with other properties bearing on the subject of this paper. These would have appeared here together with their respective physical tests were it not that their appearance would cause a great deal of discussion from deductions which could be made as to many factors that now befog and cause us ill results in mixing and melting cast iron.

I wish to state that for all the tests here reported, I hold the test specimens so that any one desiring, can examine them to see the character of the iron, etc. For the benefit of the members present at the reading of this paper I have forwarded a sample of each specialty or mixture to be presented by the chairman, Mr. O. T. Stantial, for inspection by any that may be interested.

Before going further with this paper I wish to tender thanks to all the founders who have so kindly assisted me in this work, and especially do I wish to thank Mr. J. B. Nau, of Allegheny, Pa.; Riehle Bros., of Philadelphia, Pa., and the Builder's Iron Foundry for their efficient labor and kindness in aiding me in obtaining a record of tests and forwarding the test specimens I now hold.

The micrometer measurements given in the following tables are the average of dimensions taken from the four sides of the square and round bars and hence give the size of the test specimen in the thousandth part of an inch. The common rule measurements means the size as close as it is practical to roughly state the dimensions. All the bars were cast 15 inches long and in breaking them for transverse strength they rested on pointed supports 12 inches centers. The last two columns in the tables give the strength per square inch. The outside column is used only for the half inch square bars so as to illustrate two methods of figuring, as commented upon at the close of this paper. 1.1284″ is equal to the area of one inch square; by keeping this in mind the figures in the micrometer columns can have their relation to a square inch readily defined.

The first series of tests we will present is that recording the strongest mixture; the second, the next best in strength, and so on, the last table being the weakest iron. The remarks under the heading, "State of Fracture," imply "slight" to mean just noticeable; "Small," plainly visible; "Bad," a serious flaw, and "large" or "huge," of a character a third as large at least as the area of the test bar.

TABLE I.

Transverse Tests of Gun Metal.

No. Test.	Common rule measurement.	Microm't'r measurement.	Deflection.	Broke at in pounds.	State of fracture.	Strength per square inch in pounds.	
	Rough bars.						
1	½ in. square...	.491 in.	.120in	376	Sound.	1,560	3,008
2	" " ...	.501 "	.115 "	420	"	1,673	3,360
	Planed bars.						
3	½ in. square...	491 in.	.250in	384	Sound.	1,593	3 072
4	" " ...	.495 "	.270 "	360	"	1,469	2,880
5	" " ...	.494 "	.200 "	316	"	1.295	2,582
	Rough bars.						
6	1 in. square.....	1.002 in.	.090in	3,500	Sound.	3,486	.....
7	" "	.996 "	.085 "	3.380	"	3,400	.....
8	" "	1.044 "	.095 "	3,428	"	3,145	.....
	Planed bars.						
9	1 in. square.....	1.007 in.	.130in	3,140	Sound.	3,096	.....
10	" "	1.005 "	.120 "	3,095	"	3.064	.....
11	" "	1.005 "	110 "	3,072	"	3,042	.....
	Rough bars.						
12	1⅛ in. diam....	1.132 in.	.125in	3,708	Sound.	3,686	.....
	Turned bars.						
13	1⅛ in. diam....	1.139 in.	.150in	3,320	Sound.	3,258	.....

Test bars furnished by Builders' Iron Foundry, Providence, R. I. Tested by Thomas D. West, at the works of the T. D. West Foundry Co., Sharpsville, Pa., Sept. 18th, 1894. Witnesses, Geo. H. Boyd and G. M. McIlvain.

The tests of this gun metal showed an excellent sound fracture, only one bar having a flaw and of that we have not recorded any test. The iron in the planed bars showed a very coarse grain partaking of a fibrous nature, something after a good grade of wrought iron. The metal of the rough bars showed the fracture in the ½″ square test bar to be strictly white and in the one inch square test bars to be of a crystalline mottled nature and in the rough 1⅛″ diameter bars of a similar character, but to a little less degree than shown in the one inch square bars. The planed bars presented a fracture of a dark colored, close compact grain as of a very strong iron. I wrote Mr. Robt. A. Robertson, secretary and treasurer of the Builders' Iron Foundry, for the reason of such a difference in the grain of the planed and rough bars. He answered in substance that the large open-grained bars, or those of numbers 3, 4 5, 9, 10 and 11, illustrated in table 1, were planed from the muzzle disc of a 12-inch mortar casting and bars 1, 2, 6, 7, 8, 12 and 13 were cast with metal which was used to pour a lower base ring for a 12-inch spring return mortar carriage. Mr. Robertson further said the charge of iron for the mortar was very much harder than that used for the base ring, but as it was cast in a very large mass and cooled very slowly it is not surprising that the fracture shows the iron in the mortar body to be much softer (or open grained)

*Read at the meeting of the Western Foundrymen's Association at Chicago, Wednesday evening, Oct. 24, 1894.

than that in the test bars from the base ring. Mr. Robertson says the tensile strength of the four specimens taken for acceptance of the twelve-inch return mortar or lower base casting as above described was as follows:

No. 1. 37,100 lbs. No. 3. 36,000 lbs.
No. 2. 37,000 lbs. No. 4. 32,800 lbs.

It might be well to state that it was an Olsen testing machine which the writer used for testing the above bars from the Builders' Iron Foundry, and also those from heavy machinery shown in table No. 4.

TABLE 2.

Transverse Tests of Chill Roll Iron.

No. Test.	Common rule measurement.	Microm't'r measurement.	Deflection.	Broke at (pounds.)	State of fracture.	Strength per square inch in pounds.
	Rough bars.					
14	½ in. square...	.514 in.	.100in	180	Small flaw.	682 1,440
15	" " ...	.509 "	.120 "	230	Sound.	888 1,840
16	" " ...	.518 "	.150 "	300	"	1,119 2,400
	Rough bars.					
17	1 in. square....	1.024 in.	.120in	2,130	Small flaw.	2,032 .....
18	" " ...	1.032 "	.120 "	2,590	Slight flaw	2 432 .....
19	" " ...	1.029 "	.111 "	1,795	Bad flaw.	1,697 .....
	Rough bars.					
20	1⅛ in. diam....	1.130 in.	.100in	2,220	Small flaw.	2,215 .....
21	" " ...	1 118 "	.090 "	1,745	Bad flaw.	1,777 .....
22	" " ...	1.140 "	.150 "	3,040	Slight flaw	2,980 .....
	Turned bars.					
23	1⅛ in. diam...	1.124 in.	.090in	935	Bad flaw.	943 .....
24	" " ...	1.126 "	.050 "	95	Huge flaw.	95 .....
25	" " ...	1.124 "	.190 "	3,020	Slight flaw	3,044 .....

Test bars furnished by Lewis Foundry & Machine Co., Pittsburg, Pa. Tested at the works of McConway & Torley, Pittsburg, Pa., June 27th, 1894, by J. B. Nau, of Allegheny, Pa. Witnessed by R. G. G. Moldenke, E. M., Ph. D.

Remarks by J. B. Nau: The iron in all the tests showed very good qualities and was very strong, but the heavy flaws and blow holes formed in this class of iron when cast in small pieces greatly impairs the strength. In heavy castings like rolls these defects will not happen and show the iron to be of superior quality.

Remarks by the writer: If the above bars could have been cast on end, there would no doubt have been much less occasion for referring to blow holes. A few of the sound looking pieces were selected by the writer after having been broken for transverse strength and shipped back to Mr. Nau, to be pulled for the tensile strength. No. 15 of the half inch bars pulled 6,100 lbs., exhibiting a slight flaw. No. 17 of the one inch square pulled 23,700 lbs. with a slight flaw. No. 21 of the 1⅛ inch diameter rough bars pulled 30,100 lbs., also showing a slight flaw. The iron in the half inch bars showed a white crystalline fracture, likewise the one inch square. The 1⅛ inch diameter rough bars showed a very close knit grain tending to a light color. The 1⅛ inch turned bars are also very close grained, a little darker in color than the 1⅛ inch bars, but both of the latter exhibit to an expert the appearance of great strength as being of exceptional strong metal.

TABLE 3.

Transverse Tests of Car-wheel Iron.

No. Test.	Common rule measurement.	Microm't'r measurement.	Deflection.	Broke at in pounds.	State of fracture.	Strength per square inch in pounds.
	Rough bars.					
26	½ in. square...	.474 in.	.090in	273	Sound.	1,213 2,184
27	" " ...	.496 "	.090 "	280	"	1,138 2,240
28	" " ...	.491 "	.090 "	278	"	1,158 2,224
	Rough bars.					
29	1 in. square....	1.012 in.	.075in	2,535	Sound.	2,476 .....
30	" " ...	1.022 "	.074 "	2,415	"	2,313 .....
31	" " ...	1.007 "	.075 "	2,294	"	2,262 .....
	Rough bars.					
32	1⅛ in. diam...	1.090 in.	.111in	2,340	Sound.	2,508 .....
33	" " ...	1.072 "	.100 "	2,360	"	2,615 .....
34	" " ...	1.135 "	.100 "	2,568	"	2,538 .....
	Turned bars.					
35	1⅛ in. diam....	1.151 in.	.110in	2,000	Small flaw.	1,922 .....
36	" " ...	1.174 "	.170 "	3,050	Sound.	2,819 .....
37	" " ...	1.183 "	.100 "	1,650	Bad flaw.	1,501 .....

Test bars furnished by A. Whitney & Sons, Philadelphia, Pa. Tested by John R. Matlock, Jr., at the works of Richle Bros.' Testing Machine Co., Philadelphia, Pa., June 27th, 1894. Witness, W. C. Cutler.

The iron in the half inch bars is white and crystallined. In the one inch square bar the iron is mottled tending to white. In the 1⅛ inch round rough bars the mettle is more evenly mottled and less white than in the one inch square. The 1⅛ inch round turned bars show a very rich dark gray color, and as can be seen by No. 36 the turned bar stood the greatest load per square inch of any in this table. While this iron cannot be expected to stand near the load of a chill roll mixture, still we find No. 36 is of nearly the same strength as the strongest chill roll test seen at Nos. 22 and 25, but for these latter two not showing greater strength some allowance must be made on account of the small flaws their fracture exhibited. Bar No. 33 pulled tensile 23,270. This wheel mixture proves to be an excellent iron for strength.

TABLE 4.

Transverse Tests of Heavy Machinery Iron.

No. Test.	Common rule measurement.	Microm't'r measurement.	Deflection.	Broke at in pounds.	State of fracture.	Strength per square inch in pounds.
	Rough bars.					
38	½ in. square...	.504 in.	.195in	380	Sound.	1,496 3,040
39	" " ...	.503 "	.220 "	432	"	1,707 3,456
40	" " ...	.504 "	.185 "	372	"	1,465 2,976
	Rough bars.					
41	1 in. square....	1.004 in.	.100in	2 464	Sound.	2,444 .....
42	" " ...	1.009 "	.090 "	2,510	"	2,465 .....
43	" " ...	1.007 "	.100 "	2,640	"	2,604 .....
	Rough bars.					
44	1⅛ in. diam...	1 137 in.	.100in	2,786	Sound.	2,745 .....
45	" " ...	1.135 "	.120 "	2,824	"	2,791 .....
46	" " ...	1.143 "	.100 "	2,500	Slight flaw	2,437 .....
	Turned bars.					
47	1⅛ in. diam...	1.125 in.	120in	2,257	Sound.	2,271 .....
48	" " ...	1.125 "	.150 "	2,488	"	2,503 .....
49	" " ...	1.124 "	.140 "	2.344	"	2,363 .....

Test bars furnished by the Walker Manufacturing Co., of Cleveland, Ohio. Tested by Thomas D. West, at the T. D. West Foundry Co., Sept. 18th, 1894. Witnesses, Geo. H. Boyd and G. M. McIlvain.

The iron in the half inch square test bars of which No. 39 is a sample, present a very close compact grain tending to white and would be difficult to drill. The one inch square bars could be drilled fairly well and show a close dense fracture. The 1⅛ inch round bars present more of a dark gray color than the one inch square bars and are much more easily drilled. The turned bars show a fine rich-colored compact iron such as would stand exceptional wear and resistance to fracture. Bar No. 43 pulled 26,160 lbs., and No. 44, 18,670, exhibiting a slight flaw. For medium to heavy machinery this metal should make a most serviceable casting.

TABLE 5.

Transverse Tests of Light Machinery Iron.

No. Test.	Common rule measurement.	Microm't'r measurement.	Deflection.	Broke at in pounds.	State of fracture.	Strength per square inch in pounds.
	Rough bars.					
50	½ in. square...	.499 in.	.200in	454	Slight flaw	1,823 3,632
51	" " ...	.505 "	.210 "	250	Small flaw.	980 2,000
52	" " ...	.502 "	.110 "	90	Big flaw.	357 720
	Rough bars.					
53	1 in. square...	1.016 in.	.130in	1,710	Slight flaw	1,657 .....
54	" " ...	1.021 "	.125 "	1,760	" "	1,688 .....
55	" " ...	1.008 "	.115 "	1,800	" "	1,771 .....
	Rough bars.					
56	1⅛ in. diam...	1.146 in.	160in	1,795	Sound.	1,741 .....
57	" " ...	1.156 "	.180 "	2,220	"	2,115 .....
58	" " ...	1.141 "	.180 "	1,980	Slight flaw	1,928 .....
	Turned bars.					
59	1⅛ in. diam...	1.162 in.	.200in	1,705	Sound.	1,609 .....
60	" " ...	1.160 "	.210 "	1,720	"	1,628 .....
61	" " ...	1.175 "	.210 "	1,775	"	1,637 .....

Test bars furnished by Taylor, Wilson & Co., Ltd., Allegheny, Pa. Tested by J. B. Nau, at the works of McConway & Torley, June 19th, 1894. Witness, R. G. G. Moldenke, E. M., Ph. D.

The fracture of this set of test bars show an exceptional good iron for light work. The tests record above the average for soft iron as regards strength. The color is a rich gray, devoid of that silver look many castings display that are desired to be of a soft quality. The half inch bars are the closest grained, the one inch square the next in order, then comes the 1⅛ inch in the rough, followed by the turned 1⅛ inch bars which are the most open grained, rich in color and graphite. A few of these bars were pulled for the tensile strength. The strongest half inch bar No. 50 stood 6,000 lbs. The next in strength to this No. 51 stood 5,950 lbs. The one inch square bar No. 54 stood a pull of 19,000 lbs., and No. 53 broke at 17,500 lbs. The 1⅛ inch diameter rough bar No. 56 stood 19,900 lbs. No. 58, also a rough round bar separated at 21,120 lbs. All these tensile pulled bars were sound excepting No. 54, which had a slight flaw.

TABLE 6.

Transverse Tests of Stove Plate Iron.

No. Test.	Common rule measurement.	Microm't'r measurement.	Deflection.	Broke at in pounds.	State of fracture.	Strength per square inch in pounds.
	Rough bars.					
62	½ in. square...	.475 in.	.220in	160	Sound.	711 1,280
63	" " ...	.476 "	.260 "	170	"	747 1,360
64	" " ...	.474 "	.250 "	150	"	669 1,200
	Rough bars.					
65	1 in. square...	.977 in.	.110in	1,275	Bad flaw.	1,336 .....
66	" " ...	.994 "	.150 "	1,757	Sound.	1,778 .....
67	" " ...	.975 "	.160 "	1 660	"	1,747 .....
	Rough bars.					
68	1⅛ in. diam....	1.118 in.	.170in	1,780	Sound.	1,813 .....
69	" " ...	1.127 "	.130 "	1,070	Bad flaw.	1,073 .....
70	" " ...	1.126 "	170 "	1,775	Sound.	1,783 .....
	Turned bars.					
71	1⅛ in. diam...	1.127 in.	.180in	1,320	Slight flaw	1,322 .....
72	" " ...	1.140 "	.180 "	1,440	Sound.	1,412 .....
73	" " ...	1.125 "	.180 "	1,335	"	1,343 .....

Test bars furnished by Bissell & Co., Allegheny. Pa. Tested by J. B. Nau, at the works of McConway & Torley, June 20th, 1894. Witness, R. G. G. Moldenke, E. M., Ph. D.

The test of the inch square and round bars would assert this iron to be of good strength for the work intended. A factor in this series which will no doubt attract attention is the light load the half inch bar stood in comparison with the larger sizes and only goes to further demonstrate the erratic and deceptive results which we may expect with half inch test bars. Tests taken of this iron from the bars broken for transverse strength to obtain knowledge of the tensile qualities compared very closely to those of table 5, as the half inch bar No. 54 stood 6,000 lbs. and bar No. 62 pulled 4,350 lbs. The one inch square bar No. 66 stood 16,600 lbs. and No. 65 broke at 15,900 lbs. The 1⅛ inch round rough bars No. 69 took 12,600 lbs. to fracture it, and No. 78 of the turned bars stood 17,150 lbs. All these tensile pulled bars are of perfect solid fracture, excepting Nos. 65 and 69, in which small flaws are exhibited.

TABLE 7.

Transverse Tests of Sash Weight or White Iron.

No. Test.	Common rule measurement.	Microm't'r measurement.	Deflection.	Broke at in pounds.	State of fracture.	Strength per square inch in pounds.
	Rough bars.					
74	½ in. square...	.488 in.	.062in	175	Small flaw.	735 1,400
75	" " ...	.484 "	.060 "	160	Sound.	683 1,280
76	" " ...	.487 "	.062 "	170	Small flaw.	717 1,360
	Rough bars.					
77	1 in. square...	.992 in.	.050in	1,340	Small flaw.	1,361 .....
78	" " ...	.994 "	.040 "	1,325	Sound.	1,341 .....
79	" " ...	.992 "	.055 "	1,365	"	1,386 .....
	Rough bars.					
80	1⅛ in. diam...	1.114 in.	.050in	1,355	Sound.	1,392 .....
81	" " ...	1.113 "	.055 "	1 440	"	1,480 .....
82	" " ...	1.117 "	.050 "	1.320	"	1,346 .....

Test bars furnished by E. E. Brown & Co., Philadelphia, Pa. Tested by W. C. Cutler, at the works of Riehle Bros.' Testing Machine Co., Philadelphia, Pa., June 29th, 1894.

The first factor which with many will attract the attention in this table is that of the half inch bars Nos. 74 and 76, which had a small flaw in them, standing more of a load than bar No. 75, which was sound. The only reason the writer could ascribe for such effect is that the flaws being in the middle of the half inch bars must have acted upon the principle of a hollow column being stronger than if a solid body.

Another factor to impress one in studying these tests is the uniformity of the load the bars stood and also the weight necessary to break them, for as a general thing "white iron" exhibits little strength in castings. The deductions to be drawn from these tests is in the evils emanating from excessive contraction, which is characteristic of white iron. Many castings made of white iron have been known to fly to pieces from internal contraction strains when cooling without a jar or the least weight being placed upon them. The above tests would lead us to decide that the greatest weakening element in castings made of "white iron" is due to excessive contraction. The reason for not showing any turned bars in this test is due to the difficulty or rather the impracticability of machining such a hard metal. The test bars are exceptionally solid that are noted as being free of flaws. Bar No. 82 pulled 7,125 lbs. The fracture of all the bars is of a very pronounced crystalline white appearance.

TABLE 8.

Summary of the Strongest Tests.

No. of bar.	Diameter of bars.	Transverse Strength per square inch.	Tensile. Strength per square inch.	Specialties of mixtures.
	Rough.			
12	1.132 in.	3,686	*37,110	Gun metal.
21	1.118 "	.....	30,661	Chill roll.
	Turned.			
25	1.124 in.	3,044	.....	" "
36	1.174 "	2,819	.....	Car wheel.
	Rough.			
33	1.072 in.	.....	25,782	" "
45	1.135 "	2,791	.....	Heavy machinery.
43	1.007 "	.....	25.799	" "
57	1.156 "	2,115	.....	Light machinery.
58	1.141 "	.....	20,655	" "
68	1 118 "	1,813	.....	Stove plate.
69	1 127 "	.....	12,582	" "
81	1.113 "	1,480	.....	Sash Weight.
82	1.117 "	.....	7,044	" "

* This tensile test is No. 1 of Mr. R. A. Robertson's report.

REVIEW OF TESTS.

Having completed the records of tests, it is now in order to learn what they prove. The first in the tables being the half inch square ones, we will discuss the practicability of adopting such a size as a standard to obtain the relative strength of cast iron. It will require but little study of the tables to find that it does not record any practical variation in degrees of strength, no matter what quality of iron is used. It asserts that gun metal, chill roll, car wheel and heavy machinery are no stronger than light machinery, stove plate or sash weight irons. Any one experienced in the handling or use of cast iron knows that the first four qualities of iron are stronger and have a higher commercial value for strength than the last three. The average breaking load of the several half-inch bars from gun metal, chill roll, car wheel and heavy machinery and the average of the breaking load of the half-inch bars from light machinery, stove plate and white iron, show practically the same strength, while an average of the one-inch area bars shows gun metal, chill roll, etc., to be about as strong again as light machinery, stove plate, etc.

To further illustrate the impracticability of using a half-inch square bar, we show an average of the strength of all solid bars in ½ inch square and 1⅛ inch round, rough and turned bars, in the following table:

TABLE 9.

Strong Irons.

Average of ½ in. square bars.		Average of 1⅛ in. round bars.
398 pounds.	Gun metal	3,377 pounds.
265 "	Chill roll	3,002 "
277 "	Car wheel	2,687 "
395 "	Heavy machinery	2,574 "

Weak Irons.

Average of ½ in. square bars.		Average of 1⅛ in. round bars.
454 pounds.	Light machinery	1,778 pounds.
100 "	Stove plate	1,589 "
167 "	Sash weight	1,406 "

It cannot but be plain from the above averages that the half inch square bar is an erratic size which affords no fair knowledge whatever of the true relative differences in strength of cast iron. The half inch bars from gun metal and the half inch bars from heavy machinery practically show each to be of the same strength, where the one and one-eighth round bars indicate what we would naturally expect, namely, that the gun metal is materially stronger than the heavy machinery iron, the breaking load of the first being, per square inch, 3,377 pounds, whereas the best we have of the latter is 2,574 pounds. Then again the half inch bars would indicate that the heavy machinery iron was very much stronger than the roll irons, the breaking strength of heavy machinery being indicated as 395 pounds, while the chill roll bars show only 265 pounds. The 1⅛ inch round bars record the chill roll iron to be the stronger, as shown by its breaking load of 3002 pounds, as compared with 2574 pounds for heavy machinery. The strength of the half inch bars for light machinery, 454 pounds, indicates such iron to be stronger than gun metal, chill roll, car wheel or heavy machinery iron, while the 1⅛ inch round bars show the light machinery to be but 1,778

pounds, as compared with 3,377 pounds for gun metal, 3,002 pounds for chill roll, 2,687 pounds for car wheel and 2,574 pounds for heavy machinery. The half inch bars show a breaking load of 160 pounds for stove plate and 167 pounds for sash weight or "white iron," indicating that the latter is the stronger iron, while our 1⅛ inch round bars show a strength of 1,589 pounds for stove plate, and only 1,406 pounds for sash weight iron, thus thoroughly demonstrating that inch area bars will fairly record the true relative degrees of strength of cast iron, whereas the half inch square bar gives us absolutely no knowledge or indication of any difference in strength between one mixture and another, or any irons used in the different specialties of iron founding. A fact that further demonstrates the impracticability of using ½" square test bars is that the tensile strength of Table 8 records a uniformity in degrees of strength closely corresponding with the transverse load of one inch area bars.

Some advocates of the half inch square bar tell us to multiply the breaking load of such sized bars by figure 8 in order to record the strength of cast iron per square inch. The data presented in this paper should surely prove the impracticability of such a practice, and further deductions on this point will be found at the close of this paper. The test bars taken for the exhibition of relative data and obtaining averages of half inch square vs. 1⅛ inch round bars, in the rough and turned, are such as can be classed as of all sound fractures.

ROUND VS. SQUARE ONE INCH AREA TEST BARS.

The next size and form of a bar we come to is that of the one inch square. In comparing the fracture of the square with those of the round bars I think all present will agree with the writer in asserting that the grain of the former will average denser and that the corners of all square bars, excepting those of "white iron" fracture, show the bars to be much denser at the corners than on the flat surface section of the bars, thereby causing more internal strains in a square bar and making it weaker than a round bar. This point the records of these tests fully prove, showing that the round bars record a greater strength than square bars of like areas, proving that the writer is correct in advocating the round bar as most favorable for obtaining a relative knowledge of the physical qualities of cast iron. I do not wish to be understood as saying we should adopt the method which will show the greatest strength in the bar but rather the one best to insure knowledge of the natural relative qualities of cast iron. To clearly illustrate the superiority of the round over the square bar we present the following comparison of averages in strength obtained per square inch by the sound round and square rough bars.

TABLE 10.

Summary of Best Strength Averages.

Round vs. Square Test Bars.

Gun metal	Average of	1⅛ in. round bars	3,686 lbs.
" "	"	1 in. square bars	3,344 "
Chill roll	"	1⅛ in. round bars	2,597 "
" "	"	1 in. square bars	2,232 "
Car wheel	"	1⅛ in. round bars	2,553 "
" "	"	1 in. square bars	2,350 "
Heavy machinery	"	1⅛ in. round bars	2,768 "
" "	"	1 in. square bars	2,504 "
Light machinery	"	1⅛ in. round bars	1,931 "
" "	"	1 in. square bars	1,705 "
Stove plate	"	1⅛ round bars	1,798 "
" "	"	1 in. square bars	1,763 "
Sash weight	"	1⅛ in. round bars	1,406 "
" "	"	1 in. square bars	1,362 "

The above figures present facts which should greatly aid to settle all disputes as to the value of the round over the square bar for recording the natural strength of cast iron.

TURNED TEST BARS.

The main object in testing cast iron for relative comparison should be to attain as nearly as practical knowledge of the natural strength of an iron. The turned or planed bars best give us this information, next to which can be said to come the round rough bars. Only in two instances do we find the turned or planed bars giving greater strength than the rough bars. These are seen at tests Nos. 25 and 36, the former test shows a difference of 229 lbs. compared with No. 33, while the latter shows only 64 lbs. compared with test No. 22. The conclusion from this is that as far as a shop test is concerned the rough round bar can well answer all practical purposes, and for many outside purposes it is well to have a test of both the rough and turned bars. The system which the writer advocates for casting test bars permits of obtaining rough and turned test bars, cast at the same moment and of the same ladle, better than any plan of which he is informed. The tests further show us that it is only in the strong irons that the strength of turned and rough bars can closely approximate. In the soft or weak grades of iron the difference is much more pronounced. Causes for this are very apparent when we consider the more radical differences which exist between the exterior and interior of test bars due to the "chill" which walls of the mould can give to the surface of a test bar, as contrasted with a soft or weak center of the core in a test bar. This causes the former to be more largely composed of combined carbon and the latter of graphitic carbon than we find existing in hard or strong grades of cast iron.

COMPUTATION OF STRENGTH PER SQUARE INCH.

The main aim of the writer in this work is to assist in inaugurating some system whereby the founder, blast furnace man or any one can make fair comparisons of the natural relative qualities of cast iron. Whatever systems are advanced for such testing, I claim that none should be recognized as worthy of any consideration that requires us to take into account more than ⅛ of an inch from the size of a test bar pattern to draw deductions for figures in strength per square inch. It matters not what size of a bar we take, be it ½ inch, 1½ inch, 2 inch, or 4 inches square or round, the moment we attempt to figure down or up to ascribe a metal's strength per square inch or the more we divert from the exact size of the bar actually tested, the more we will err in drawing correct relative deductions as to different grades of cast iron. The two columns of deductions relating to the strength per square inch with ½ inch square bars shown in this paper will illustrate the errors such bars lead to I cannot believe such a practice, even with bars of 1½ square inch area, being carried up to two or four inches would prove much better to compute it up or down to strength per square inch without leading us to error in drawing conclusions as to relative values of cast iron. I would say such computations, in order to obtain a relative knowledge of cast iron, must be confined to the use of one size of bar and its computation should only be permitted in taking into account any variation which may exist due to irregular work in the molding and casting of that one sized bar. And in testing bars this effect from irregularity in molding, which can cause a variation in the size of test bars, should be taken note of in compiling any records of strength filed for reference or comparison. Note should be taken of the least variations which might exist in the size of a test bar, as a few thousandths part of an inch in the diameter of a bar is multiplied about three times in its circumference. A little variation in the size of a test bar will make a bar stronger or weaker according as its diameter is decreased or increased from the size of the pattern from which the test bars are molded. In compiling this paper it will be observed that the writer has thought it correct to recognize this factor, and hence the adoption of the column, "Strength per square inch," seen with most of the tables given herewith.

In order that the reader may quickly define and understand how strength per square inch was obtained for the tables above, we give two examples below, as one method is necessary for a square bar and another for a round bar.

SQUARE BAR. TEST NO. 6. TABLE I.

Micrometer Meas.	Square.	Area of bar.
1.002 in.	x 1.002 in.	= 1.004 square inches.
Breaking load.		Area.
3,500 lbs.	÷	1.004 = 3,486 lbs. strength per sq. in.

ROUND BAR. TEST NO. 12. TABLE NO. I.

Diameter.	Diameter.	Square of diameter.
1.132 in.	x 1.132 in.	= 1.281424 square inches.
Square of diam.	Decimal.	Area.
1.281424	x .7854	= 1.006 square inches.
Breaking load.	Area.	
3,708	÷ 1.006	= 3,686 lbs. strength per sq. in.

While the above comments are intended to be applied in figuring "strength per square inch" to any or all sizes of bars, the writer's study and experience would indicate that the 1⅛ inch round bar, which he advocates as the best form and size for obtaining a knowledge of the relative qualities of cast iron has many points to recommend its general adoption over any other size which might be advanced. The records of this

paper, I think, fully sustain the practicability of using a 1⅛ inch round bar for testing all grades of cast iron. And I would here say that the bar that cannot achieve such a result is of no value at all, for one reason, if no other. It is not practical to define where one size of a bar might leave off and another begin in giving us a knowledge of the natural relative qualities of cast iron.

The writer wishes it understood that this paper treats of relative tests only, and aims to advance the establishment of some system as a standard for obtaining relative results. There is another kind of test other than relative and which might be termed special test. But on this latter the writer expects before long to present a paper with a view of proving that each class has its own sphere and that they should be largely independent of each other in giving valuable data as to the qualities of cast iron.

We now urgently need the adoption of some one system whereby the founder can detect any variation in the natural physical qualities of his mixtures and whereby the blast furnace men if called upon, can inform a customer of the natural strength, deflection, chill. and contraction, as well as chemical analysis of an iron, one to be a check to the other. This knowledge obtained, it is then left for the founder to judge what effect the sand, the rammer, the swab, the chill, or the form and thickness of a casting can have in perverting an iron from its natural state. He then can act accordingly in making his mixtures to best attain the end desired. When this day comes, founders will find that chemical and physical tests mean a more favorable balance at the end of the year and a much greater uniformity in daily results from a mixture than is generally attained at the present day.

WE remember the instance of a machine tool that had been built and re-built, and it was never satisfactory in its operations. Then another took a hand in the matter, knocked off the unsatisfactory legs, and set the bed right down on a satisfactory foundation of masonry, and the whole thing was complete.—[American Machinist.

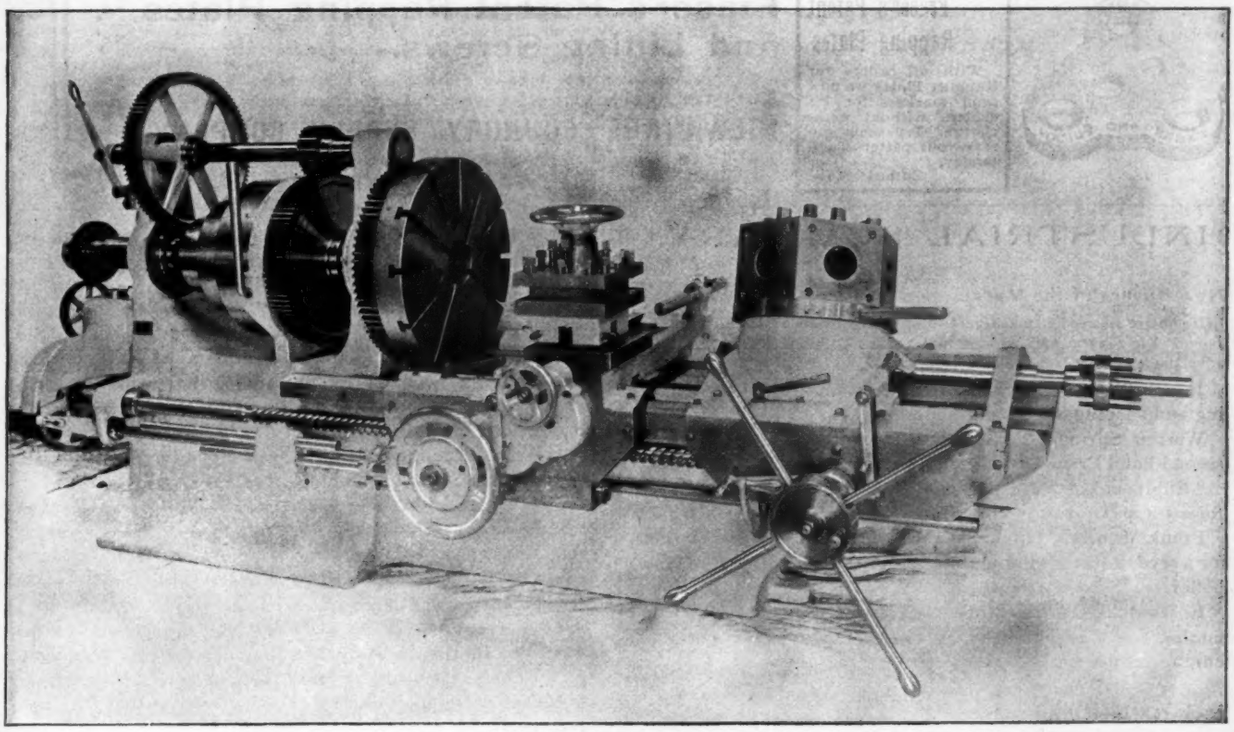
THE "S. S. Curry," the largest vessel on the lakes, having a capacity of 4,500 tons of coal, was recently unloaded in one day at Gladstone, Mich., by means of the C. W. Hunt Co.'s coal handling machinery.

A SPECIAL from New Lisbon, O., says that 100 men and 30 teams are at work on the new tin mill being erected there. The estimated cost of the plant is $150,000.

A HEAVY TURRET LATHE.

The variety of uses for which turret lathes may be employed has increased greatly in the past few years. From being used for making studs, bolts, screws, etc., their range is now an extensive one in work both heavy and light. A late machine turned out by the Gisholt Machine Co., of Madison, Wis., who have given much attention to this class of equipment, is shown in the illustration. This lathe swings 28 inches over the shears, is provided with friction back geared head stock, and also with a drive directly on the chuck, making, in connection with a three speed counter shaft, 27 speeds in all.

The feed is effected by means of a coarse pitch screw running in rotary nuts in the carriage and turret aprons. This feed is by far the smoothest and stiffest that can be applied to a turret lathe, and is of great value in shaving off broad surfaces by means of wide shaving tools. By means of the splined rod and lever shown, the feed can instantly be varied by the operator in the ratio of 1, 2, 4 and 8 without leaving his position at the pilot wheel. This feed is of special value in short rapid cuts that are used in the turret machine, as almost every operation requires for best economy two different rates of feed. The first boring cut may be made with a feed of 16 per inch; for the next tool, which removes much less stock, a feed of eight cuts per inch is instantly obtained, or in some cases four cuts can be used to advantage. The next operation may require a fine feed as, perhaps, 16 or 32 cuts per inch, either of which is readily obtained by moving the lever without stopping the machine. The gain resulting from the use of this device in average work is set down by the makers at not less than 15 or 20 per cent. under average shop conditions.



A HEAVY TURRET LATHE.

This lathe is fitted with turret tool post carriage carrying four tools and with a standard turret. The cut shows the lathe fitted for turning Corliss engine bonnets. The first operation is to bore the hole by means of fluted drills accurately ground to size. The special turning tools are then used which face the end of the bonnet, turn the steam lever, fit and make the shoulder. At the same time that the special turret tool is turning the steam lever fit a special carriage tool is used for facing down the flange.

All attachments are provided that tend toward increasing the output, and the lathe throughout is very massive and powerful. As an illustration of what can be done on this machine, a Corliss engine bonnet for a 26 inch cylinder was completely finished, including the back end, in 45 minutes. Twelve can be finished on this machine in a day.

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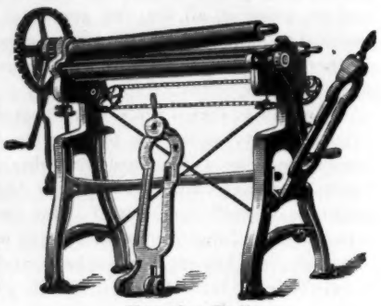
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INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

Joseph Black, of Blacksburg, S. C., wants prices on stamping and shaping sheets and plates.

Warren Springer, 207 Canal st., Chicago, wants to buy a second-hand Crane elevator engine.

"Engineer," 237-239 Market st., Chicago, is in the market for a 5 h. p. 110-volt motor, second-hand.

Frank M. Elliot, 123 LaSalle St., Chicago, is in the market for a second-hand sand pump and a four h. p. engine and boiler.

E. W. Williams, 1120 Monadnock Block, Chicago, is in the market for a second-hand 15 to 30 horse power portable engine and boiler.

New Construction:—

The Baltimore & Ohio Railroad Co. contemplates the erection of large machine and repair shops at Baltimore, Md.

Matthai, Ingram & Co., tin plate manufacturers at Baltimore, are building a seven-story, fire-proof warehouse 78x145 feet.

H. Mayer & Co., of Philadelphia, will put up a building 30x170 feet, for the manufacture of files. They will also build a boiler shop 27x52 feet in size.

The new plant of the Frankton, Ind., Iron Foundry & Machine Co. will be started this week, and the work of construction will be pushed rapidly.

The John O'Brien Boiler Works Co., of St. Louis, Mo., will erect a new boiler shop opposite its old one which will be modern and complete in every detail.

The Southern Railway Co. will soon commence work upon a new and large machine shop in Atlanta, Ga. The old shops of the company will be removed to the new one when it is completed.

Mackintosh, Hemphill & Co., of Pittsburg, will shortly erect a new building for the manufacture of tin plate, and propose to have a model plant in every respect. The company will buy black plates. The engines to be used in the plant will be of the heaviest type.

The Reading Iron Co., of Reading, Pa., will construct a plant for the manufacture of skelp iron. The plans have not yet been decided upon, but a tract of ground adjoining the Keystone Furnace has been secured. All the machinery to be used will be constructed by the company at its Scott Foundry department.

The proposed plant at Hyde Park, Pa., is to be a sheet mill and not a tin plate plant. No strikers are connected with the enterprise and it will not be co-operative, as at first reported. The incorporators are J. D. Orr, and T. S. Irwin, of Leechburg; W. E. Lloyd and J. M. Fiscus, of Apollo, and E. F. Schauwecker, of Philadelphia.

The shops of the Kansas City Car & Foundry Co., at Kansas City, Mo., are nearly completed. They cover 14 acres of ground, and consist of a blacksmith shop 50x112 feet, an erecting shop 250x175 feet, a wood mill 75x112 feet, an engine room 32x60 feet, and a drying room for the lumber. It is expected that the works will be in operation by Nov. 1, when the company expect to employ 500 men.

The Carnegie Steel Co. will shortly begin work on an extensive addition to its producing capacity. A short time ago the company bought a large tract of land adjoining the steel plant at Duquesne, and it is now given out that four new blast furnaces, of large capacity, will be built on it. The furnaces will supply material for the Duquesne mill alone. They will be modeled after furnaces H and I at the Edgar Thomson works.

The J. R. Thomas Machinery Co., of Green Bay, Wis., will erect a woodworking-machinery plant in the near future. All of the buildings except the office and pattern shop, which will be frame, will be constructed of brick. The buildings to be erected are as follows: Foundry, 50x140 feet; machine shop, 60x150 feet; pattern shop, 30x75 feet; office, 16x25 feet; boiler and engine house, 25x42 feet; blacksmith shop and cleaning room, 22x42 feet.

The Tasker Pipe Co.'s new plant at Bethlehem, Pa., is nearly completed, and will be put in operation within a short time. The building is of frame, 70x120 feet, and will be used for the manufacture of pipe under the patents of Stephen P. M. Tasker. The machinery to be used in the works will be furnished by the Bethlehem Foundry & Machine Co. and Geo. V. Cresson, of Philadelphia. The company will turn out pipe for stacks, water pipes, etc.

Fires and Accidents:—

At Cincinnati, the asbestos works of the Philip Carey Mfg. Co. burned with $50,000 loss; insurance $33,000.

The foundry and machine shop operated by Stewart & Mun-

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nigal, at Webb City, Mo., burned lately, entailing a loss of $8,000.

The axe factory of M. M. Pillsbury, at Napanoch, N. Y., was destroyed by fire on the 14th instant. Loss, $25,000; no insurance.

The shops and round house of the Michigan division of the Big Four Railroad at Wabash, Ind., burned with $100,000 loss; insurance one-half.

Hubbard Foundry & Machine Works burned at Hubbard, O., Oct. 24. Loss $15,000; insurance, $6,000. The foundry had orders ahead to run for several months.

The Deering Harvester Co., of Chicago, suffered a loss of $225,000 by fire at its plant on Fullerton Ave., Oct. 26. The fire started in Warehouse No. 31, which was filled with baled hemp, manila and sisal material for the manufacture of binder twine, and extended to Warehouse No. 32, which contained finished farm machinery and twine machinery. Warehouse No. 31, which was totally destroyed, was 200x150 feet and of brick construction. The loss was divided as follows: Reaping machinery, $150,000; twine material, $50,000; twine machinery, $15,000, and building, $10,000. Fully covered by insurance.

Additions, Enlargements, Removals, Etc.:—

The Youngstown (O.) Car Mfg. Co. is at work upon an addition to their erecting works.

W. Dewees Wood & Co. will build an additional forge at their plant at McKeesport, Pa., commencing work at once.

The Adams Co., of Dubuque, Ia., has just finished a large addition, 28x40 feet, to its foundry, making the foundry 115x140 feet.

At Wheeling, W. Va., the Warwood Tool Works has leased additional buildings, and will put in new machinery to employ 50 more hands.

The Wagner Mfg. Co., of Sidney, O., has just completed an addition to its foundry buildings and has added a number of machines to its finishing department.

The Arcade File Co., of Anderson, Ind., announces that it will erect a two-story brick 98x60 feet addition to its already large plant, which has doubled capacity within the past year. A full force is working full time.

Chandler & Farquhar, dealers in machinery supplies and hardware at 177 and 179 Washington St., Boston, have removed their stores to 36 Federal St., running through to 133 Congress St., where they will occupy a store and basement 40x85 feet. Their machinery department, formerly at 23 and 25 Purchase St., will be consolidated at the new location.

The Buckeye Mfg. Co., of Union City, Ind., now removing to Anderson, Ind., has at its works in the latter place the most modern and convenient arrangements. A number of the new tools which will be used by the company will be furnished by the Chicago office of the Prentiss Tool & Supply Co.

General Industrial Notes:—

Lime Rock Furnace, in Litchfield County, Conn., has started up after an idleness of three years.

The new car wheel works at Raleigh, N. C., which have been building for several months, have been put in operation.

An effort will be made to reorganize the Kellogg Seamless Tube Co., of Findlay, O., with the object of starting up the plant.

The Kelly, Belfont and Eagle mills, and the Sarah, Belfont and Hamilton furnaces in the Ironton, O. district are all running.

The Fowler Bolt Works at Anderson, Ind., which have been shut down for the past two years, have recently been started up on full turn.

The Glamorgan Pipe & Foundry Co., of Lynchburg, Va., which burned recently, has resumed operations, having completed its new buildings.

There is some talk of forming a company to lease and operate the Anniston, Ala., Rolling Mills, built in 1890 at a cost of $150,000, but never active.

East Canaan Furnace of Barnum-Richardson Co., of East Canaan, Conn., which has been idle for a long time, will probably be started up soon. New boilers have been put in.

The Bessemer (Ala.) Land & Improvement Co. at a recent meeting further perfected plans for the new steel plant, and President H. F. DeBardeleben goes to Boston to arrange for beginning construction.

The Board of Trade of Niles, O., has taken an option on several tracts of land on the outskirts of the town and proposes to offer free sites to manufacturers locating there. Several industries are now considering Niles.

The Reading Iron Co.'s Keystone Furnace, at Reading, Pa., has been blown out after a continuous run of two years. It is likely that the two Reading furnaces will be blown in in the near future, as they have been put in repair lately.

At Bessemer, Ala., the Howard Harrison Co. will build new coke ovens and add considerable new machinery, which will

increase its capacity one-half. Two new pits for pipe casting are contemplated. The present output is 200 tons a day.

The machine shop and patent saw works, at Homewood, Pa., part of the estates of Gustave Ehrhardt and Gustave Ehrhardt & Sons, of Pittsburg, will be sold Oct. 31 at public sale. The plant is 100x265 feet, and is equipped with valuable machinery.

The blast furnace plant of the Onondaga Iron Co., at Geddes, N. Y., has been purchased by the Solvay Process Co., of Syracuse, N. Y. The company will utilize the furnace, which has been idle for a long time, for its own special purposes.

The Texarkana Car & Foundry Co., of Texarkana, Ark., has made an assignment for the benefit of its creditors. The assets are estimated at $30,000; liabilities not known. The reason for the failure is given as hard times and failure to make collections.

The property of the Crane Iron Co., at Catasauqua, Pa., has been bought by the bond holders, and it is expected that about the first of the year a new company, composed of the bondholders, will take possession and will run the plant under the name of the Crane Iron Works.

The York structural steel plant at Ironton, Duluth's suburb, is in operation and is turning out 12-inch beams. The new machinery with which it is expected to roll 36-inch beams is in place and a pressure pump is all that needs to be installed. Since the plant shut down, after a trial of the equipment, $75,000 has been put into new machinery. About $350,000 has been expended altogether.

The Hercules Bronze & Galvanized Iron Co., of 3322 Halsten St., Chicago, confessed judgment last week in favor of Charles L. Schaar and Horatio Thomas in the respective amounts of $3,863 and $837. The assets of the company are scheduled at $15,000, and debts are said to be not in excess of this amount.

The reorganization of the Diamond Drill Co., of Birdsboro Pa., has been completed, and the works will be operated under the name of the Diamond Drill & Machine Co. The incorporators are George Brooke, Edward Brooke, Robert E. Brooke, William H. Rahne and Philip S. Zeiber. The works are already in operation.

At Canton, O., an effort is being made to straighten out the affairs of the C. Aultman Co. and the Akron Iron Co., of Akron. Mrs. Alice N. Chance, of Canton, who was the wife of Jacob Miller, and who received from his estate a large interest in the C. Aultman Co. and the Akron Iron Co., offers to turn over to creditors $1,000,000 worth of property, reserving $28,000 worth, including a homestead. Lewis Miller has also made a proposition which is now being considered.

A COMMITTEE of bondholders of the United Brass Co., of Lorain, O., have been examining the plant with a view to starting it up at an early date.

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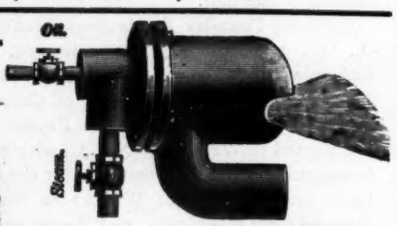

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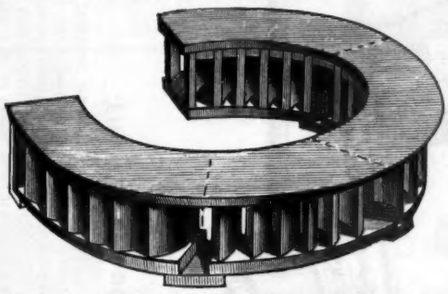

Fig. 1—The Combination of Sections of Tuyeres as placed in wall.

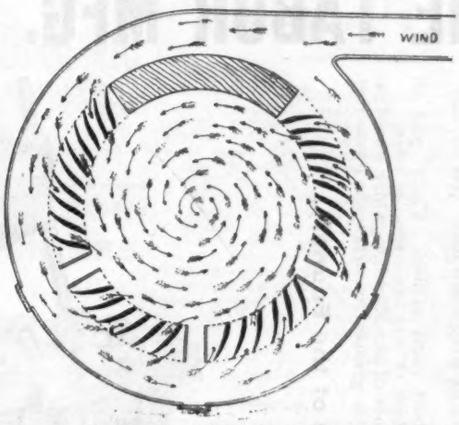

Fig. 2—Showing direction of Wind through the Curved Tuyeres.

Upon the manner of introducing the blast into the cupola depends the degree of combustion attained, consequently that form of tuyeres which will produce maximum results at a minimum cost is the great desideratum. We assert that this has been reached in the "Blakeney" tuyeres to a higher and more satisfactory degree than in any other device known, whether it be a combination of upper and lower tuyeres, a series of pipes, or the old-fashioned tuyeres; and we are certain that a little reflection on the part of any one familiar with cupola practice, will convince him that the projection of the blast through CURVED tuyeres will not only insure its penetration nearer to the center of the cupola, but its more even distribution to all parts of the cupola as well. It is upon this self-evident fact that we base our claim of the attainment of a combustion more nearly approaching perfection than by any other method. With better combustion it necessarily follows that there must be greater economy of fuel, faster melting, less "hanging up," and the production of a more uniform grade and strength of iron. In a word, the "Blakeney" cupola is a continual source of profit and satisfaction in a foundry, and to any one desirous of improving their melting facilities, or who are in the market for a new cupola, we shall be pleased to send a descriptive catalogue. We are quoting "hard time" prices and solicit the privilege of submitting figures. To those whose cupolas are being run at a daily loss as compared with the results attained in the "Blakeney," we desire to state that we are prepared to apply these patent tuyeres and air-chamber to old cupolas at a nominal cost when the shell is in good condition.

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DANVILLE, ILL., Sept. 12, 1894.

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Yours truly, DANVILLE FOUNDRY & MACHINE CO. By Wm. Stewart, Pres.

FULTON, ILL., Aug. 29, 1894.

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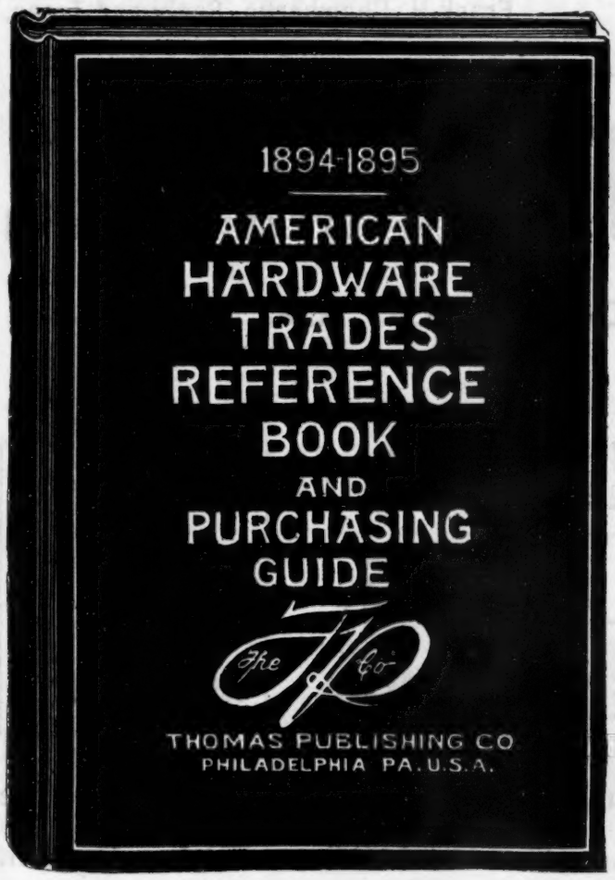

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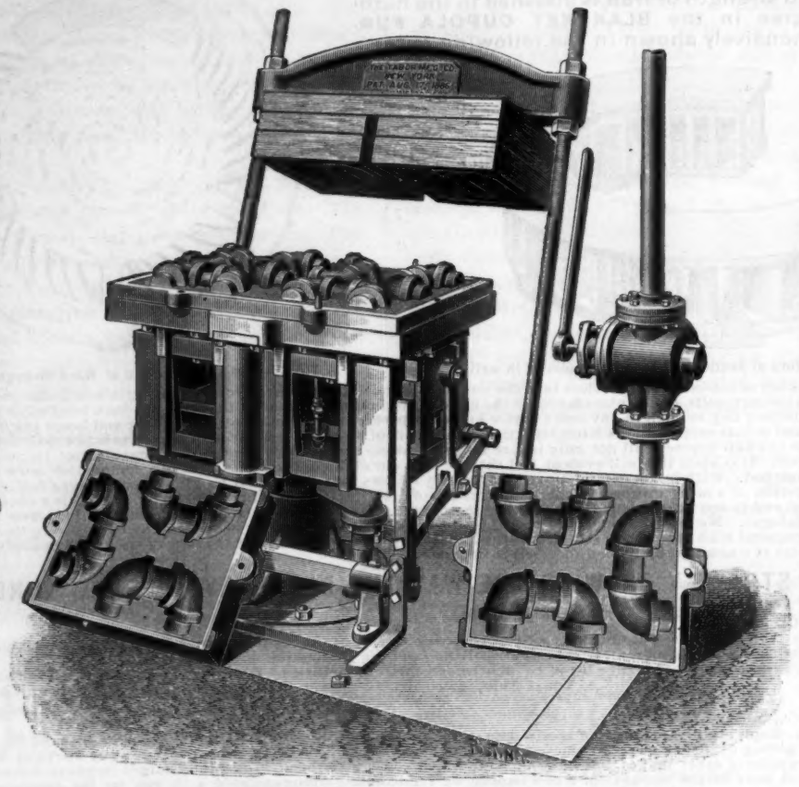

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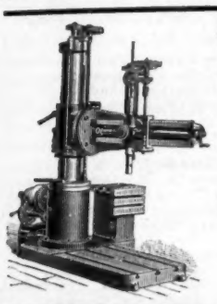

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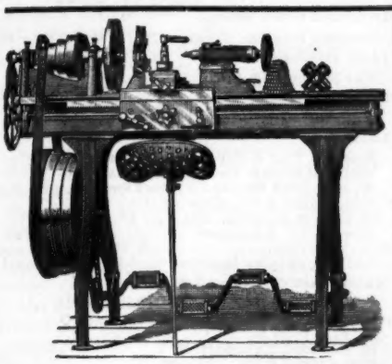

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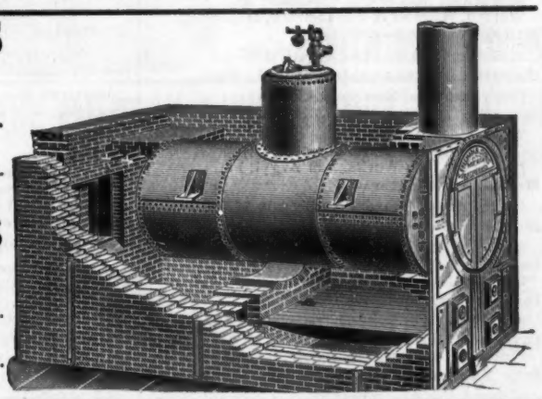

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Foot and Power Lathes—
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Hill, Clarke & Co., Chicago, Ill.
Dawson & Goodwin, Chicago, Ill.
New York Machinery Depot, 178 Broadway, New York City.
Lodge & Shipley Machine Tool Co., Cincinnati.

Foundries—
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Brightman Stoker Co., Cleveland, O.
The Lloyd-Booth Co., Youngstown, O.
Taylor & Boggis Foundry Co., Cleveland, O.
Wm. Tod & Co., Youngstown, O.
S. Freeman & Sons Mfg. Co., Racine, Wis.

Foundry Supplies—
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American Fire Brick & Clay Co., Mineral Point, Ohio.
Clearfield Fire Brick Co., Clearfield, Pa.
Millett Core Oven Co., Brightwood, Mass.
Ohio Sand Co., Conneaut, O.
Milwaukee Fdy. Supply Co., Milwaukee, Wis.
Cleveland Facing Mill Co., Cleveland, O.
Tabor Mfg. Co., New York City.
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Geo. B. Grant, 86 Seneca st., Cleveland, O.

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E. K. Morris & Co., Cincinnati, O.

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C. W. Hunt Co., New York City.

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C. W. Hunt Co., New York City.
Pen Argyl Iron Works, Pen Argyl, Pa.

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G. B. Schulte Sons Co., Cincinnati, O.
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Geo. B. Grant, 86 Seneca st., Cleveland, O.
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Hill, Clarke & Co., Chicago, Ill.
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Office of THE CLEVELAND IRON ORE PAINT CO. and THE GARRY IRON ROOFING CO.,
CLEVELAND, O., Jan. 25, 1894.

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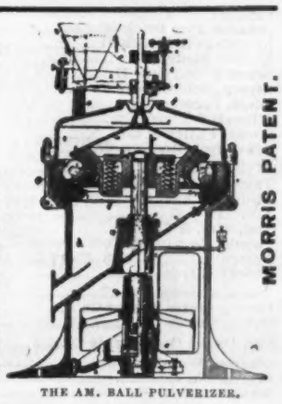
CLEVELAND IRON ORE PAINT CO.



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Lv. Cleveland, 6:15 P. M. | Lv. Buffalo - 6:15 P. M.
Ar. Buffalo, - 7:30 A. M. | Ar. Cleveland, 7:30 A. M.

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Take the "C. & B. Line" steamers and enjoy a refreshing night's rest when en route to **Buffalo, Niagara Falls, Toronto, New York, Boston, Albany, 1,000 Islands,** or any Eastern or Canadian point.

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No. 1 Specular, Bessemer	3.00@ 3.35
No. 1 Bessemer hematite	2.75@ 3.00
Hematites No. 1 non-Bessemer	2.00@ 2.50
No 1. Specular, non-Bessemer	2.35@ 3.00

PIG IRON.

CLEVELAND (f. o. b. cars):

Bessemer	$11 00@$11 25
No. 1 Strong Foundry	11 40@ 11 65
No. 2 Strong Foundry	10 50@ 10 75
No. 1 Gray Forge, red short	9 75@ 00 00
No. 2 Gray Forge, neutral	9 25@ 00 00
No. 1 American Scotch	11 65@ 00 00
No. 2 American Scotch	10 65@ 00 00
Lake Superior Charcoal	13 00@ 13 50

PITTSBURG:

No. 1 Foundry	$11 50@$11 75
No. 2 Foundry	10 50@ 10 75
Gray Forge	9 75@ 10 00
White and Mottled	9 00@ 9 25
Warm Blast Charcoal	18 00@ 19 00
Cold Blast Charcoal	22 00@ 26 00
Bessemer	11 00@ 00 00

CHICAGO (reported by our representative:)

Lake Superior Charcoal	$13 00@$14 50
Local Coke Foundry No. 1	10 25@ 10 50
Local Coke Foundry No. 2	10 00@ 10 25
Local Coke Foundry No. 3	9 50@ 10 00
Local Scotch Foundry No. 1	10 75@ 11 00
Local Scotch Foundry No. 2	10 00@ 10 50
Local Scotch Foundry No. 3	9 50@ 10 00
Southern Coke No. 1	11 00@ 11 25
Southern Coke No. 2	10 00@ 10 25
Southern Coke No. 3	9 75@ 10 00
Southern No. 1 Soft	10 00@ 10 25
Southern No. 2 Soft	9 75@ 10 00
Southern Silveries No. 1	11 50@ 11 75
Southern Silveries No. 2	11 25@ 11 50
Jackson Co. Silveries	15 00@ 16 00
Ohio Silveries No. 1	14 00@ 14 50
Ohio Silveries No. 2	13 00@ 13 50
Ohio Strong Softeners	13 00@ 13 50
Alabama Car Wheel	17 50@ 18 00
Southern Charcoal No. 1	15 50
Southern Charcoal No. 2	14 50
Malleable Bessemer	10 50@ 11 25
Coke Bessemer	11 25@ 11 50

CINCINNATI (reported by Rogers, Brown & Co.)

Southern Coke No. 1, Foundry	$10 00@$10 25
Southern Coke No. 2 and No. 1 Soft	9 50@ 9 75
Hanging Rock Coke, No 1	12 00@ 12 50
Hanging Rock Charcoal No. 1, Fdy	16 00@ 17 00
Tennessee Charcoal No 1	14 00@ 14 50
Jackson County Stone Coal No 1	14 50@ 15 00
Southern Coke, Grey Forge	8 50@ 8 75
" " Mottled	8 25@ 8 50
Standard Alabama Car Wheel	15 75@ 16 75
Tennessee " "	15 50@ 16 00
Lake Superior " "	14 00@ 14 50

BUFFALO (reported by Rogers, Brown & Co.)

No. 1 Foundry Strong Coke Iron Lake Superior Ore	$11 75
No. 2 Foundry Strong Coke Iron Lake Superior Ore	11 25
Ohio Softener No. 1	12 25
Jackson Co. Silvery No. 1	15 75@ 16 75
Lake Superior Charcoal	15 50
Tennessee Charcoal	15 50
Southern Soft No. 1	11 75
Southern Soft No. 2	11 25
Alabama Car Wheel	16 00@ 17 50
Hanging Rock Charcoal	18 50

LOUISVILLE (reported by Geo. H. Hull & Co.)

Southern Coke No. 1 Foundry	$10 00@$10 50
Southern Coke No. 2 Foundry	9 25@ 9 50
Southern Coke No. 3 Foundry	8 75@ 9 00
Gray Forge	8 50@ 8 75
Southern Charcoal No. 1 Foundry	12 50@ 13 50
Car Wheel	15 00@ 15 50
Spathite	11 25@ 11 75

ST. LOUIS (reported by Rogers, Brown & Meacham):

Southern Coke No 1	$10 75@$11 25
Southern Coke No. 2	10 25@ 10 75
Southern Coke No. 3	9 75@ 10 00
Southern Gray Forge	9 50@ 9 75
Southern Charcoal No. 1	14 00@ 14 50
Missouri Charcoal No. 1	12 50@ 13 00
Ohio Softeners	14 00@ 14 50
Lake Superior	15 50@ 16 00
Southern	16 75@ 17 00
Connellsville Coke, St. Louis	4 50

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[Prices paid by mills.]

	GROSS TONS
Old iron rails	$12 50
Old steel rails	10 00
	NET TONS
No. 1 R. R. wrought scrap	$ 9 50
No. 1 wrought scrap	8 50
No. 1 Machine cast scrap	8 50
Iron axles	15 50
Axle turnings	8 00
Wrought turnings (free from cast)	6 50
Cast borings	5 50
Uncut wrought iron boilers	4 00
Steel boiler plates	8 00
Grate bars	5 50
Pipes and flues (clean)	7 00
Tank iron	6 75
Hoop and band iron	6 00
Sheet iron	5 00
Wrought drillings	6 50
Malleable iron	7 00

Frank P. Cady, Pres. and Supt.
Geo. H. Bowler, Sec'y and Treas.

THE CADY MFG. CO.

283 W. River St., CLEVELAND, O.

AUTOMATIC MACHINERY.
Power Presses, Dies, Drop Hammers, Punches and Shears, Wire Straighteners and Cutters, Wire Forming Machines
SEND FOR CATALOGUE.

PERFORATED METALS
OF ALL KINDS FOR
MILLING MINING AND AGRICULTURAL MACHINERY,
PERFORATED IRON, STEEL, COPPER, BRASS, TIN, ZINC, LEAD, ETC., TO ORDER.
LARGE AND VARIED ASSORTMENT OF SIZES. CORRESPONDENCE SOLICITED.
THE ROBERT AITCHISON. PERFORATED METAL CO.,
OFFICE, ROOM 510 265 TO 269 DEARBORN STREET, CHICAGO, ILL. WORKS SOUTH CHICAGO.

Splice Bar Punch. (1)

—THE—
Long & Allstatter Co.
HAMILTON, O., U. S. A.

Manufacturers of Belt, Steam and Electrically driven
POWER PUNCHES and SHEARS,
for all kinds of Boiler, Tank and Structural Iron Work, Rolling Mills, Locomotive Shops, Car and Wagon Shops, Plow Shops, etc. Send for Catalogue.

A. H. LEITCH, PRES JOHN C. LEITCH, SEC. AND GENL. MAN. JOHN A. WILSON, TREAS.

WESTMORELAND FIRE BRICK CO.
MANUFACTURERS OF HIGH GRADE **FIRE BRICKS.**
PITTSBURG, PA.
Works and Mines, Westmoreland, Pa.

PL DIXON'S PERFECT LUBRICATING GRAPHITE.
The most Marvelous Lubricant Known.
Used Dry, or Mixed with Water, Oil or Grease
NOT AFFECTED BY HEAT, COLD, STEAM OR ACIDS.
An Interesting and Instructive Pamphlet will be sent Free of Charge.
JOS. DIXON CRUCIBLE CO. Jersey City, N. J.

IRON CLAD PAINT CO.
Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.
CLEVELAND, OHIO.

ORDER DIRECT FROM THE
Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. mill)	1.25c@1.35c
Angles	1.20c@1.25c
Tees	1.35c@1.45c
Universal Plates	1.20c
Sheared Plates	1.30c

MERCHANT IRON AND STEEL.

[List prices out of store.]

Flat Bar.

1½ to 4 by ¾ to 1 inch	1 30
4½ to 6 by ¾ to 1 inch	1 35
1¾ to 6 by 1¼ to 2 inch	1 50
1¼ & 1¾ by ⅜ to ¾ inch	1 35
1 & 1¼ by ⅜ to ¾ inch	1 40
⅝, ⅞, ⅞, by ⅜ to ⅝ inch	1 50

Round and Square.

1 to 1⅞ inch	1 30
2 to 2⅝ inch	1 40
2¾ to 3¼ inch	1 55
3⅜ to 4 inch	1 80
4¼ to 4½ inch	2 40
4¾ to 5 inch	2 60

Oval.

⅜ to 1¼ inch	1 50
⅜ to ¾ inch	1 50
½	1 70
⅝	1 90

Half Oval and Half Round.

1½ to 3 inch	1 85
⅜ to 1½ inch	1 65
⅜ to ¾ inch	1 90
½	2 05
⅝	3 15

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch	1 40
1 to 1¾ by ¼ and 5-16 inch	1 45
¾ to ⅞ by ¼ and 5-16 inch	1 55
½ to ⅝ by ¼ and 5-16 inch	1 80

Hoop Iron.

1 7-16 to 4, No. 13, 14, 15 and 16	1 85
1 7-16 to 2, No. 17, 18 and 19	1 90
1 7-16 to 2, No. 20	2 00
1 7-16 to 2, No. 21	2 10
1 7-16 to 2, No. 22	2 20
1⅛ to 1⅜, No. 13, 14 and 15	1 90
1⅛ to 1⅜, No. 16, 17 and 18	1 95
1⅛ to 1⅜, No 19 and 20	2 00
1⅛ to 1⅜, No. 21	2 10
1⅛ to 1⅜, No. 22	2 20
15-16 and 1 inch, No. 13, 14 and 15	1 85
15-16 and 1 inch, No. 16, 17 and 18	2 00
15-16 and 1 inch, No. 19 and 20	2 10
15-16 and 1 inch, No. 21	2 20
15-16 and 1 inch, No. 22	2 30
⅞, No. 13, 14 and 15	2 10
⅞, No. 16, 17 and 18	2 20
⅞, No. 19 and 20	2 30
⅞, No. 21	2 40
⅞, No. 22	2 50
13-16, No. 13, 14 and 15	2 20
13-16, No. 16, 17 and 18	2 30
13-16, No. 19 and 20	2 40
13-16, No. 21	2 50
13-16, No. 22	2 60
¾, No. 13, 14 and 15	2 30
¾, No. 16, 17 and 18	2 45
¾, No. 19 and 20	2 55
¾, No. 21	2 65
¾, No. 22	2 75
11-16, No. 13, 14 and 15	2 55
11-16, No. 16, 17 and 18	2 60
11-16, No. 19 and 20	2 70
11-16, No. 21	2 80
11-16, No. 22	2 90
11-16, No. 23	3 00
⅞, No. 13, 14 and 15	2 60
⅞, No. 16, 17 and 18	2 70
⅞, No. 19 and 20	2 80
⅞, No. 21	2 90
⅞, No. 22	3 00
⅞, No. 23	3 10
9-16, No. 13, 14 and 15	2 80
9-16, No. 16, 17 and 18	2 90
9-16, No. and 20	3 00
9-16, No. 21	3 10
9-16, No. 22	3 20
9-16, No. 23	3 30
7-16 and ½ inch, No. 13, 14 and 15	3 00
7-16 and ½ inch, No. 16, 17 and 18	3 10
7-16 and ½ inch, No. 19 and 20	3 20
7-16 and ½ inch, No. 21	3 30
7-16 and ½ inch, No. 22	3 40
7-16 and ½ inch, No. 23	3 50
⅜, No. 13, 14 and 15	3 50
⅜, No. 16, 17 and 18	3 60
⅜, No. 19 and 20	3 70
⅜, No. 21	4 00
⅜, No. 22	4 10
⅜, No. 23	4 25

Light Band.

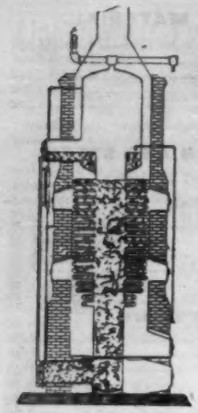
1¼ to 6 by ⅛ to 3-16 inch	1 60
1½ to 6 by Nos. 11 and 12	1 65
1 to 1¾ by ⅛ to 3-16 inch	1 65
1 to 1¾ by Nos. 11 and 12	1 70
⅞ and 13-16 by ⅛ to 3-16 inch	1 80
⅞ and 13-16 by Nos. 11 and 12	1 85
¾ and 11-16 by ⅛ to 3-16 inch	1 90
¾ and 11-16 by Nos. 11 and 12	1 95
⅝ and 9-16 by ⅛ to 3-16 inch	2 05
⅝ and 9-16 by Nos. 11 and 12	2 10
½ by ⅛ to 3-16 inch	2 20
½ by Nos. 11 and 12	2 25

Wagon Box Iron.

⅞ inch, beveled edge, by Nos. 11 and 12	1 80
⅞ inch, " " " " 13 and 14	1 90
¾ inch, " " " " 11 and 12	1 95
¾ inch, " " " " 13 and 14	2 15

Sheet Iron.

No. 10	1 85
No. 12	1 90
No. 14	1 95



THE ADAMS
WATER TUBE BOILER.

This Boiler is absolutely safe from explosion. Gives as much steam from the waste heat as any boiler made. Easy of access for cleaning and repairs. Furnishes perfectly dry steam. Occupies little ground space. Economical in first cost. Send for complete circulars giving list of users and testimonials, one of which is printed below.

The Falcon Tin Plate & Sheet Co.,
NILES, O., Aug. 18, 1893.

Chas. P. Adams, Esq.

Dear Sir: The three boilers of 225 H. P. each which you furnished us are working in every way satisfactory. We consider them as good steamers as any we have ever used. Up to the present time have spent nothing on them for repairs. Very respectfully,

THE FALCON TIN PLATE & SHEET CO.,
By Warner Arms, Pres't.

C. P. ADAMS.
807 The Cuyahoga, - CLEVELAND. O.

C. W. HUNT COMPANY,
45 Broadway, New York,

THE HUNT TIP CAR.

MANUFACTURERS OF
HOISTING AND CONVEYING MACHINERY

For moving all kinds of material in Steam Power Stations, Factories, Gas Works, Mines, Coal Yards, etc.

Tip Cars, Wire Rope, Barrows.
INDUSTRIAL RAILWAYS.

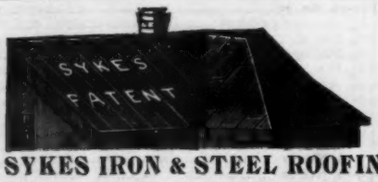
Manufacturers' Tool Supply Co.,
DEALERS IN A FULL LINE OF
MACHINISTS' SUPPLIES.
No. 17 South Canal Street, Chicago.

Morse Twist Drills, Kearney & Foot's Files, Wiley & Russell's Lightning Screw Plates, etc, Billings & Spencer's Wrenches, etc.

CLEVELAND ROLLING MILL CO.,
CLEVELAND, - OHIO,

—MANUFACTURERS OF—
BESSEMER AND OPEN-HEARTH STEEL,

Blooms, Billets, and Slabs, Steel Rails, Steel Beams, Channels and Angles. Steel Forgings, Bar Spring, and Sleigh Shoe Steel. Steel Wire of all kinds. Barbed Wire, Iron and Steel Plates, Galvanized and Black Sheet Iron and Steel Corrugated Iron Roofing.



WORLD'S FAIR AWARD.

We are the only Steel Roofing Co. awarded Medal and Diploma for **PATENT CAP ROOFING** at World's Columbian Exposition. We are also large manufacturers of all styles of METAL ROOFING, SIDING, CEILING, ETC. Send for Catalogue and Price List. Mention this paper.

SYKES IRON & STEEL ROOFING CO., - Chicago and Niles, O.

Moffet Portable Drill
UNSURPASSED AS A REAMER.

Weighs 48 pounds and drills from ⅜ to 2 inches diameter.

Runs with Steam or Compressed air.
Will Work in Any Position.
An Economical Substitute for Rachet Drilling.
Send for Circular.

MANUFACTURED BY
J. G. TIMOLAT
89 and 91 S. Fifth Ave., NEW YORK.

Subscribe for The Iron Trade Review, $3 per year.

No. 15-17	2 05
No. 18	2 20
No. 20	2 30
No. 22-24	2 40
No. 25.26	2 50
No. 27	2 60

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 60
Shell	1 85
Flange	2 10
Marine Flange	2 35
Fire Box	3 35

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. ℔. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs.
1 to 2 in, inclusive	08
9-16 to ⅞ in. "	08½
7-16 to ⅜ and 2⅜ to 3 in.	09
3⅛ to 4 in	09½
⅜ to 11-16 and 4⅛	10
⅛ to 6 in	10½
¼ to 9-32 and 6⅛ to 7 in	11
3-16 in	13

Flats.

	cts. lbs.
2 to 9-16 in. wide by 2 to ⅛ thick	8

Bessemer and O. H. Steel.

Machinery	base price, 1 80
Tire	" 1 85
Spring	" 2 20
Sleigh Shoe	" 2 20
Toe Calk	" 2 05
Cutter Shoes, tapered and bent	" 2 45

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 70
Bridge ½, ⅝, 11-16 and ¾ inch diam	3 40

MACHINERY SUPPLY MARKET.

Anvils.

American	℔ lb 9@10
Wright's	℔ lb 12

Bellows.

Blacksmiths' Hill's	dis 40
Blacksmiths' Bullock's	dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single,	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis 45

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 35
Horton's Universal	dis 40
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 20

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Crowbars.

Cast Steel	℔ 3½
Iron, steel points	℔ lb 3

Drill and Drill Sockets.

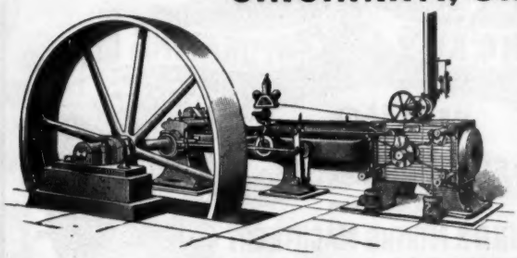
Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1⅛"	dis 50&10
Morse Taper and Straight Shank Larger than 1⅛"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

Emery.

	No. 4 to No. 54 46 gr.	150 gr.	Flour, C. F F. FF.
Kegs, ℔	4½c	5 c	2½c
½ kegs ℔	4¾c	5¼c	2¾c
¼ kegs ℔	5 c	5½c	3 c
10 lb cans, 10 in case	6 c	6½c	5 c
10 lb cans less than 10	10 c	10 c	7½c

THE LANE & BODLEY CO.,

CINCINNATI, OHIO.



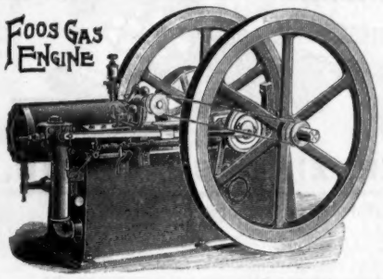
Engines.

ALL SIZES.

Simple and Compound.

Shafting, Hangers, Pulleys.

Belt Elevators, Saw Mills.



THE FOOS GAS AND GASOLINE ENGINES.

FROM 1 TO 50 HORSE POWER.

These Engines give a regular, steady speed
Can be run with Manufactured Gas,
Natural Gas, and Gasoline.

MANUFACTURED BY THE

FOOS GAS ENGINE CO.

SPRINGFIELD, OHIO.

LIGHT, CHEAP, COOL, DURABLE,

COLLECTS NO MOISTURE FROM UNDER SIDE.
NO DRIPPINGS.

Resists acids and gases arising from inside of FOUNDRIES, IRON WORKS, MILLS, ETC.

Litho-Carbon Paint for Metal Roof sand Sidings, Bridges, Smokestacks, etc., covers more space than any other Paint; dries quick, won't crack, peel or blister; will stand a heat of 550° Fahrenheit. Send for 32-page catalogue.

EMPIRE PAINT & ROOFING CO.

111 No. Fourth St., Philadelphia, Pa.

CLEVELAND

GALVANIZING

WORKS.

H. H. HODELL & CO.,

Galvanizing in all its branches, and Manufacturers of Rubber Buckets for chain pumps.

CLEVELAND, OHIO.

ONE DOLLAR A YEAR

BUILT TO PLEASE.

The reading matter is of such a nature as to be of practical value and interest to hardware dealers. It does not discuss mechanical or manufacturing topics, because its subscribers are hardware dealers, not makers of hardware.

PAYS ITS ADVERTISERS,

For the simple reason that it gives them an honest equivalent for their money, by placing their announcements in the hands of the buyers of their goods at a reasonable cost.

For Sample Copy and Rates, address,

The Hardware Dealers' Magazine,

D. T. MALLETT, PUBLISHER,
78 Reade St., NEW YORK.

SPEND YOUR OUTING ON THE GREAT LAKES.

Visit picturesque Mackinac Island. It will only cost you about $12.50 from Detroit; $15 from Toledo; $18 from Cleveland, for the round trip, including meals and berths. Avoid the heat and dust by traveling on the D. & C. floating palaces. The attractions of a trip to the Mackinac region are unsurpassed. The island itself is a grand romantic spot, its climate most invigorating. Two new steel passenger steamers have just been built for the upper lake route, costing $300,000 each. They are equipped with every modern convenience, annunciators, bath-rooms, etc., illuminated throughout by electricity, and are guaranteed to be the grandest, largest and safest steamers on fresh water. These steamers favorably compare with the great ocean liners in construction and speed. Four trips per week between Toledo, Detroit, Alpena, Mackinac, St. Ignace, Petoskey, Chicago, "Soo," Marquette and Duluth. Daily between Cleveland and Detroit. Daily between Cleveland and Put-in-Bay. The cabins, parlors and staterooms of these steamers are designed for the complete entertainment of humanity under home conditions; the palatial equipment, the luxury of the appointments, makes traveling on these steamers thoroughly enjoyable. Send for illustrated descriptive pamphlet. Address A. A. SCHANTZ, G. P. & T. A., D. & C. Detroit, Mich.

Emery Cloth and Paper.

Barder, Adamson & Co.	dis 50@50&5
H. H. Barton	dis 50@50&5

Emery Wheels.

Detroit	dis 60@70
Norton's	dis 60@70
Grant	dis 60@70
Sterling	dis 60@70
Celluloid	dis 10&33⅓
Northampton	dis 55
Crystal	dis 65@70
Vitrified	dis 60@70
Vulcanite	dis 60&10
Hamden	dis 60&10@70
Cyclone	dis 60@60&10

Files.

Arcade	dis 60&10@60&10&10
Nicholson	dis 60&10@60&10&10
" X. F.	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
McClellan	dis 60&10@60&10&10
Disston's	dis 65@70
Western	dis 70
Stub's	dis 25
Grobet's	dis 30
Reynolds Bros.' Hand Cut	dis 50
Industry File Works Hand Cut	dis 50

Hammers.

P. S. W	dis 40
Atha new list, Jan. 15, 1887	dis 50
Heavy hammers and sledges under 5 lbs	13c
" " " " over 5 lbs	10c

Jack Screws.

Illinois Bolt Co. list	dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¼	4	3½	3⅛
Hexagon	15½	11½	8½	6	5¼	5¼	
Washers	9	8	7	5	4½	4½	4⅛

In lots less than 100 lbs, ₩ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

List July 14, 1887	dis 85
Standard Penny Nails, ₩ keg card rate	
Car lots	$1.10
Less than car lots	$1.25

Oilers.

Zinc and Tin	dis 60
Brass and Copper	dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz	dis 10@10&10

Packing, Steam.

Boston Belting Co.	dis 60
American Packing Hemp	₩ lb 9@10
Russia " "	₩ lb 14
Italian " "	₩ lb 13@19
Plumbago Piston	₩ lb 40
Peerless	₩ lb 60
Morrison's "	₩ lb 45
Square Flax "	₩ lb 50
Sheet Rubber	₩ lb 12&24
Excelsior Rubber	₩ lb 48
Rainbow	Full Rolls 45c ₩ lb; Less than Full Rolls, 50c ₩ lb
Eclipse Gasket	₩ lb 75

Picks.

Railroads, 5 to 6 lbs	$12 dis 60
" 6 to 7 lbs	$13 dis 60

Pulleys.

Iron Pulleys, Walker List	dis 50
Medart Pulleys	dis 50
Split Wood Pulleys	dis 55@60

Rivets.

Iron, Thousand, list November 17, 1887	dis 50&10@60
Iron, Ordinary, Cooper's Block and Carriage list November 17, 1887	dis 50&10@60
Copper	dis 50@50&10

Saws.

Disston's Circular	dis 40&10
" Band	dis 25
" Scroll	Net
Hack Saw Stubs	dis 20
" " Eureka	dis 20
" " Star	dis 20
Saw Swages Diston's	dis 30
Atkins' Circular Saws	dis 40&45
" Mill, Mulay and Drag Saws	dis 40&10
" Wood Saws	dis 40&10
" Silver Steel Diamond Cross-cut Saws	70c per ft
" Dexter Cross-cuts	50c "
" Diamond "	30c "
" Tuttle Tooth Cross-cuts	25c "
" One-man Cross-cuts	32c "
No. 1 Handles	23c per pair
No. 6 "	16c "
Excelsior Saw Tools	$6 per doz
Derfection "	$15 "
Petroit Saw Works, Circular	dis 50
" " " Band	dis 25
" " " Mulay	dis 45

Taps.

Cards, Hand and Nut to 2 in	dis 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " " new list	dis 10
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 55
Pulley Taps	dis 40

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 15@20
Howard	dis 35

Wire.

New List, Apr. 9, 1894

Brass	dis 40
Copper	dis 40
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis65& 5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	95c ₩ lb dis 30

Wrenches.

Coe's genuine	dis 50
Girard Standard	dis 70&10
Agricultural	dis 75&10
Mechanic's	dis 55&10& 5
Bemis & Call's Combination	dis 35
Donohue's Engineers	dis 20&10
Lamson & Sessions Engineers	dis 60
Billings & Spencer's Drop Forged	dis 25
William's " "	dis 25
Alligator " "	dis 40

Cleveland Union Station.

Pennsylvania Lines.

Foot of Bank Street.

TICKET OFFICES at Station, Euclid Av., Woodland Av., and Weddell House corner.

THROUGH TRAINS RUN AS FOLLOWS BY CENTRAL TIME
* Daily. † Daily, except Sunday.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	† 7.45 am	†11.55 am
Pittsburgh, Bellaire and East	†12.45 pm	† 6.25 pm
Philadelphia and New York	* 1.40 pm	*11.15 am
Baltimore and Washington	* 1.40 pm	*11.15 am
Alliance and Pittsburgh	* 1.40 pm	*11.15 am
Ravenna and Alliance	† 3.25 pm	† 9.50 am
Hudson and Ravenna	* 5.10 pm	* 8.15 am
Philadelphia and New York	*11.10 pm	* 5.25 am
Baltimore and Washington	*11.10 pm	* 5.25 am
Alliance and Pittsburgh	*11.10 pm	* 5.25 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8.40 am	* 5.15 pm
Akron, Columbus & Zanesville	†2.45 am	*11.55 pm
Akron and Columbus	* 8.40 pm	*5.15 pm
Akron and Orrville	† 3.25 pm	† 9.50 am
Columbus and Cincinnati	* 8.00 pm	* 7.00 am

Valley Ry.

Depot foot of So. Water St.
City Office 143 Superior St.

	Arrive.	Depart.
Akron & Canton	*6:35 P M	*7:10 A M
Akron, Canton & Valley Jctn.	*10:10 A M	*3:15 P M
Valley Jctn. & Way Stations	†6:35 P M	†7:10 A M
Akron, Canton & Chicago	*8:00 A M	*6:30 P M
Wooster and Garrett	†3:00 P M	†11:00 A M
Wooster		*6:30 P M
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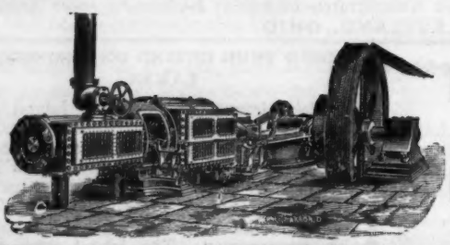

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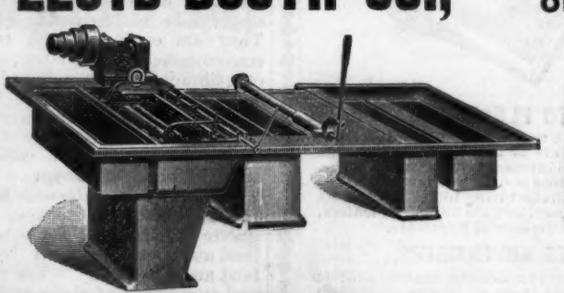

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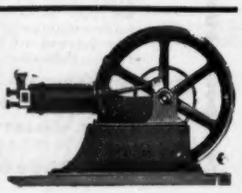

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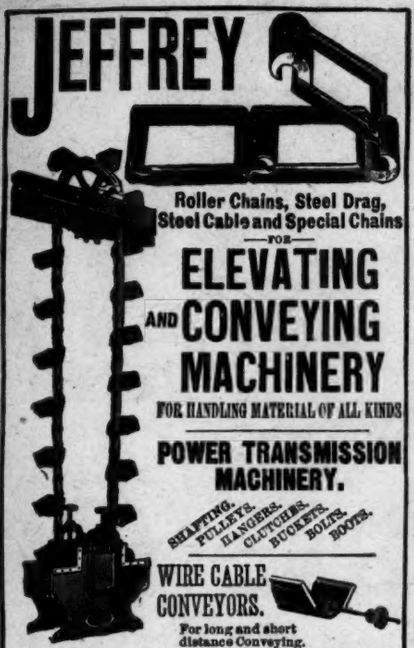

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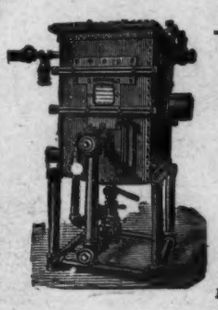

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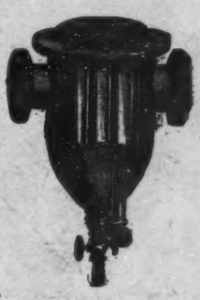

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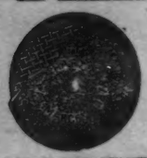

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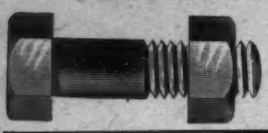

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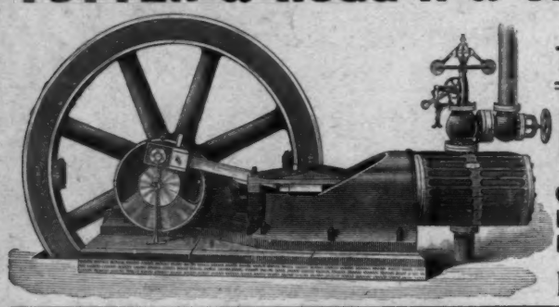

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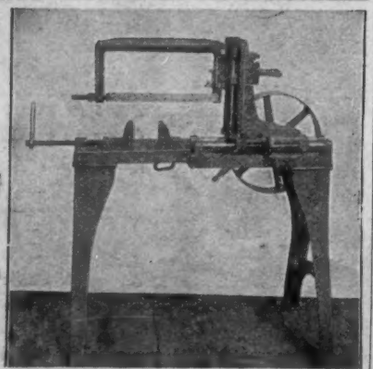

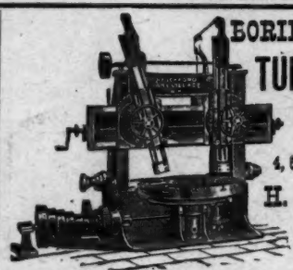

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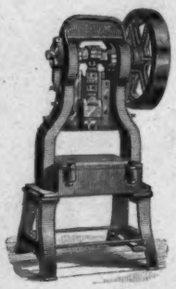

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